

USER MANUAL

FUSION



PROPRIETARY INFORMATION

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1 ADDENDUM FUSION

For a complete list of changes and more detailed information about firmware versions, please consult the Product Change Notice documents available under “RESOURCES” at www.multitel.com.

1.1 AVAILABILITY

The most recent firmware version is available for purchase from Multitel or it is available free if you have, or if you subscribe for a service contract with Multitel. Contact your sales representative for more information at order@multitel.com.

1.2 UPDATE PROCEDURE

Firmware version 4.95 can be uploaded to any FUSION and should not impact the configuration and neither the log files, however, it is a recommended practice to backup your configuration files and download your statistics and history files before performing the firmware update.

Note that a FUSION v4.94 can be rolled back to a previous firmware version but we recommend to perform the rollback “on site” as we have experience from time to time, IP address reverting to factory default values during our testing. Also, a complete operating parameter reset will have to be performed manually for optimal operation. Please contact Multitel technical assistance should you have any concerns or questions.

1.3 KNOWN BUGS

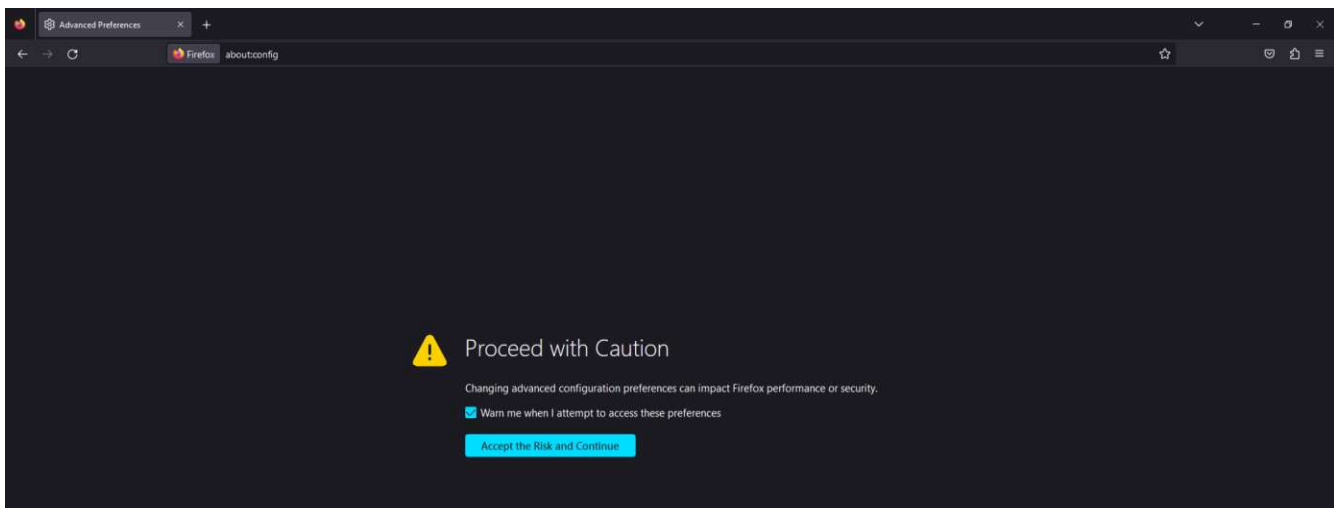
Unfortunately, there are some known bugs that were not addressed with the release of v4.95. They may be dealt with later in a future version. For your information, here is a snippet of the most relevant bugs:

- **FUS-53** – For HTTP secure communications (HTTPS), FUSION v4.95 currently supports TLS 1.0 and 1.1, unfortunately, these version are deprecated by major browsers namely Chrome, Edge and Firefox. A possible workaround is to use legacy Internet Explorer version or to use Firefox and adjusting the following customer settings:
 - Modify the “security.tls.max.version” to value of 1
 - Modify the “security.tls.min.version” to value of 1
 - Modify the “network.http.max-persistent-connections-per-server” See the instruction on the next page or contact Multitel at support@multitel.com for technical assistance.
- **FUS-82** – When a FUSION triggers a relay and remains on for a long period of time, the relay may be heard turning on and off intermittently for a short duration (300ms) during an interval of 20-30 minutes. We are investigating the cause of this behavior and will communicate a fix in a future release.
- **FUS-99** – Using a DNS (Domain Name Server) with v4.95 does not work. It is essential to configure the IPv4 address in each field of the operation parameters for proper functioning.
- **FUS-141** – The LCD display is not support with version v4.95 and beyond.

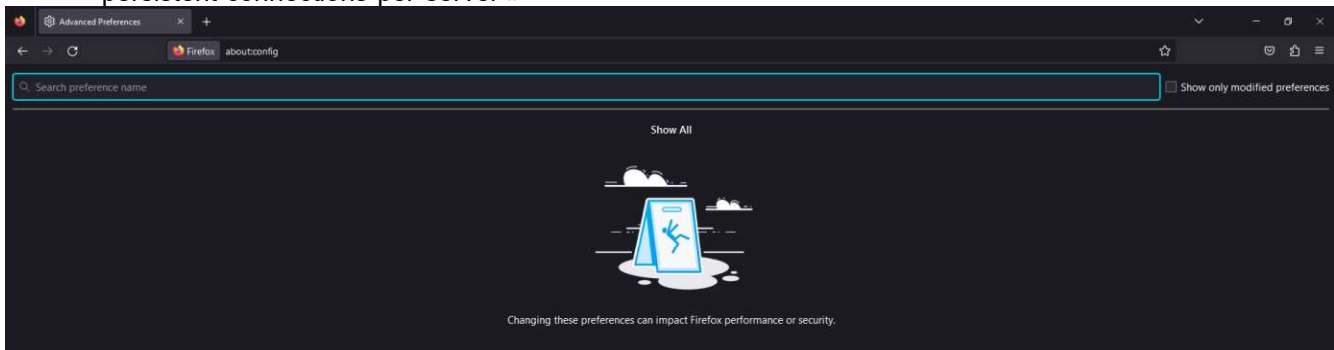
1.4 PERFORMANCE HTTPS

Multitel recommends the use of Firefox browser to communicate in the secure http mode as other browsers make the communication unusable. Firefox lets you fix the TLS version supported and allows you to adjust the number of http persistent connection to increase performance with the FUSION web server. Following are the step-by-step procedure to modify the parameter in the Firefox settings.

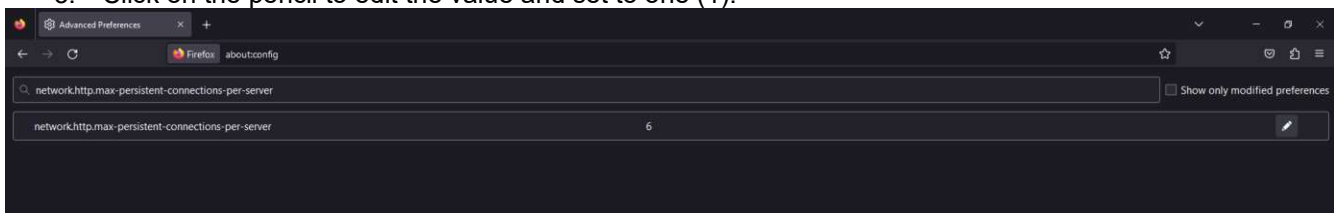
1. Open Firefox and type “About:config” in the address bar and then click on the risks acceptance button to proceed.



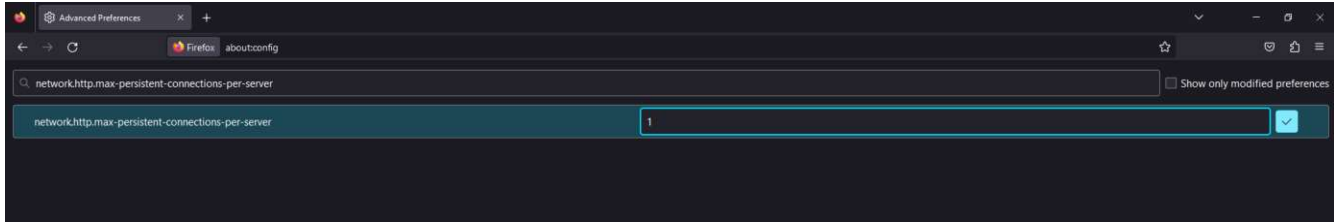
2. Click on “Show all” in to make all option available and in the search bar type « network.http.max-persistent-connections-per-server »



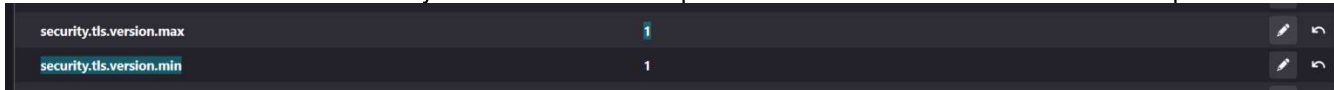
3. Click on the pencil to edit the value and set to one (1).



4. Then click the arrow button to save the change.



5. Next search for the “security.tls.version” and setup value to 1 for the both the Max and Min parameters.



The change will remain you only have to do it once.

1.5 LIST OF ENHANCEMENTS

Following is the list of new features added to the FUSION when operating with firmware version 4.90 which are not described in the current user manual.

1.5.1 Derived channels removed

As mentioned in the PCN, the following derived channels have been removed and are no longer available in the FUSION firmware version 4.90. Thus, before performing the FUSION firmware update, verify if these channels were in use as they will no longer be performing their intended task.

- Access
- Access Control
- PID
- Dialup bridge

1.5.2 Dynamic channels

FUSION provides many various derived channels for alarming, automation, timing and computation purposes. In previous firmware versions, FUSION would limit the availability of these channels to a fix quantity, meaning that if more channel of a certain type were required, FUSION would not allow this. Ex.: Binary Manual (64), Arithmetic (220), Chronometer (10) and so forth.

In firmware version 4.90 it was decided to increase the limit to a quantity of 2048 channels for the following specific derived channel types. The new quantity of 2048 is dependent of FUSION available resources. Meaning that when the FUSION reaches its total memory limit, the FUSION will not allow more channels to be added, regardless of their type.






- Arithmetic
- Binary Manual
- Battery Runtime
- Chronometer
- Constant
- Duty Cycle/Average
- Lead/Lag
- Lookup table
- Groups
- Ping
- Programmable delay
- Schedule
- Threshold
- Time Set Point
- Watthour
- Peak (new)

Acquisition of SNMP or MODBUS module I/O channels will also benefit from the dynamic channels concept. SNMP and Modbus modules continue to be limited to 64 modules; however, their respective I/O channels have been increased to 2048.

The following software component have kept a fix quantity limit in FUSION firmware version 4.90.







- Callout (32)
- Font panel LED (16)
- Links (20)
- Modules (64)
- SNMPget (64)
- User (16)

1.5.3 Dynamic channel management



When configuring the dynamic channel for the first time, the  button will appear in the top right corner of the screen, click the  button to add a channel, you will then be prompt to edit the channel state, set the state to “**1 : Enabled**” to activate the channel, Once the channel is activated the list of all parameters will be offer for the user to configure accordingly. Click the  button to make it visible in the list of existing channels from now on, the  button can be clicked at any time. The number associated to the channel starts at 1 and will increase consecutively by 1 as new channel is added to the list. To remove a channel, you must be in CONFIG mode and click the desired channel mnemonic and click the  button and then set its state to “**2 : None**”, the channel will disappear from the list and it will becomes reusable when a new channel is added.

FUSION v4.90 can now accommodate up to 64 SNMPget and 64 Modbus modules, each module can be configured with a user configurable quantity (limited to 2048) of analog and binary channels as follow:

FUSION performing OID gets from various SNMP devices	GT(x)A(y)	(x) = 0 to 64, (y) = 0 to 2048
	GT(x)E(y)	
FUSION performing Modbus data acquisition on generic modules. <i>No changes to SMX modules.</i>	M(x)A(y)	(x) = 0 to 64, (y) = 0 to 2048
	M(x)E(y)	
	M(x)O(y)	
	M(x)R(y)	

Use the   to add analog input or binary input channels respectively to a GT(x) module. Use the     to add analog input, analog output, binary input or binary output respectively to a M(x) module.

IMPORTANT NOTES

- Many channels can be added without clicking the  button, all the new channels added will remain non visible from the list and will only be made visible when the  button is clicked by the user.
- There is no delete button, a channel can be removed from the list by changing the channel state from “Enabled” or “Disabled” to “None”. The state “None” will remove the channel from the list and it will make it reusable by the system when adding a new channel of the same type.

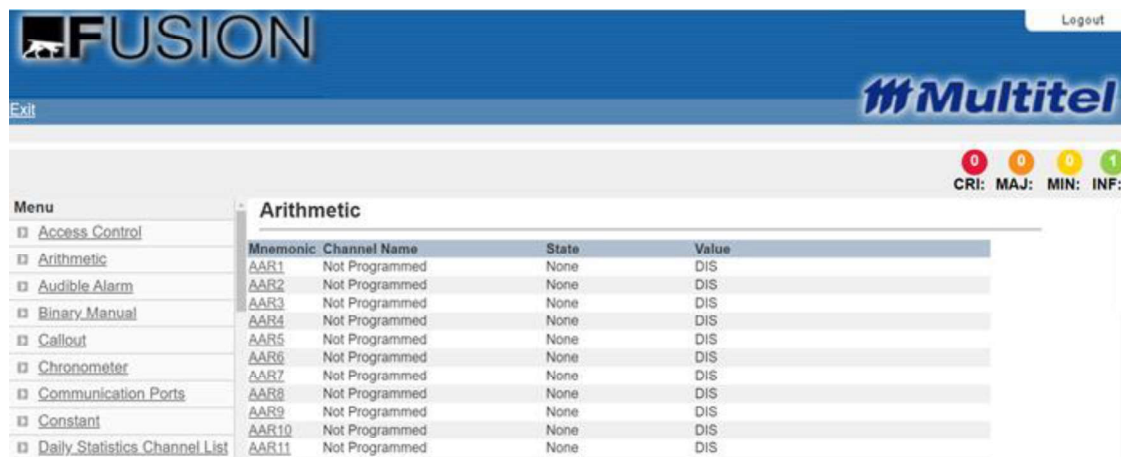
WEB CONFIGURATION EXAMPLE

To illustrate what changed with the dynamic channel configurations, following is a before and after example based on the Arithmetic channels AAR(x).

Before example:

Following is the process when configuring AAR(x) in previous FUSION firmware version. There is a limited number of 220 AAR(x) channels available for configuration. The user must:

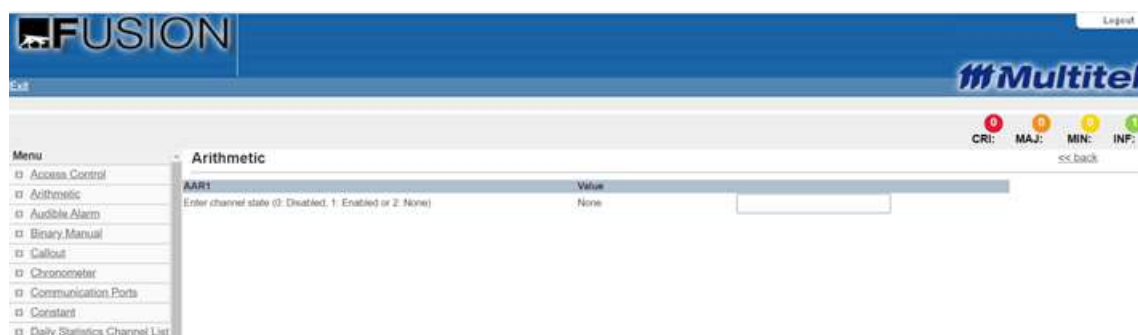
1. Pick any AAR(x) channel from the available list, where (x) is a fix number between 1 and 220.



2. Once selected, click the **Edit** button to modify the current operating parameter setup



3. Once in editing mode, select **"1: Enabled"** from the available states to activate the channel.



4. Once the channel is enabled, the other AAR(x) parameters are made available for configuration, click **Apply** to save changes and exit the editing mode.

After example:

Following is the new process to configure an Arithmetic AAR(x) with the firmware version v4.90 version:

1. Once Arithmetic is selected from the left menu, the list of existing channels is empty, click to add an AAR(x) channel

2. The next available AAR(x) channel is provided directly in editing mode, enter “1” to select “**Enabled**” from the available states to activate the channel.

3. Once the new channel is enabled, supplementary parameters are made available for configuration, click to save changes and this make the channel visible in the existing channel list. If the button is not clicked, the button will remain visible and all editing changes will not be visible until the button is clicked.

1.5.4 NEW BATTERY RUNTIME (BRES)

Non-liability Disclaimer

Multitel will not be held responsible for any loss of service, loss of revenues or loss of data suffered by the misuse, mismanagement of this battery runtime functionality.

Multitel does not warrant the accuracy, neither the proper operation of the battery runtime as erratic configuration entry, computation is based on battery ratings coming from the battery manufacturer which may not reflect the actual condition of the battery, it's state of health and neither its actual remaining capacity. Beside the actual load current, the battery runtime algorithm will not take in consideration other parameters (temperature, state of charge, age of battery, etc..) that can impact the battery reserve condition and estimated runtime.

The Battery Runtime (BRES(X)) is a new derived channel aimed at providing users a battery rundown counter that triggers when a power outage occurs. The BRES(x) channel will continuously compute a hardcoded algorithm that estimates the battery runtime based on predetermined battery parameters values configured by the user. Upon the detection of a battery discharge is underway (user configurable), the computation will stop and a countdown will initiate from the last battery runtime computed value, providing the "estimated battery runtime". The countdown will continue as long as the trigger is activated or until it reaches the 00h00m00s mark. The resulting value can be viewed in HMI pages or directly from the derived channels page when selecting the "Battery Runtime" from the left side menu. More importantly, this value can be either polled by performing SNMP get or it can be sent through an SNMP trap to a Fault Management System by means of a CALLOUT(x) derived channel.

The algorithm is based on the Ah (Amp – hour) rating provided by the battery vendor specified at the 8-hour discharge rate:

$$\frac{\text{Battery String (Ah)} \times \text{Number of Strings} \times \text{End Discharge (EoD) Voltage}}{(\text{Total Load Current} \times \text{DC Plant Float Voltage})} \times \text{CF1} \times \text{CF2}$$

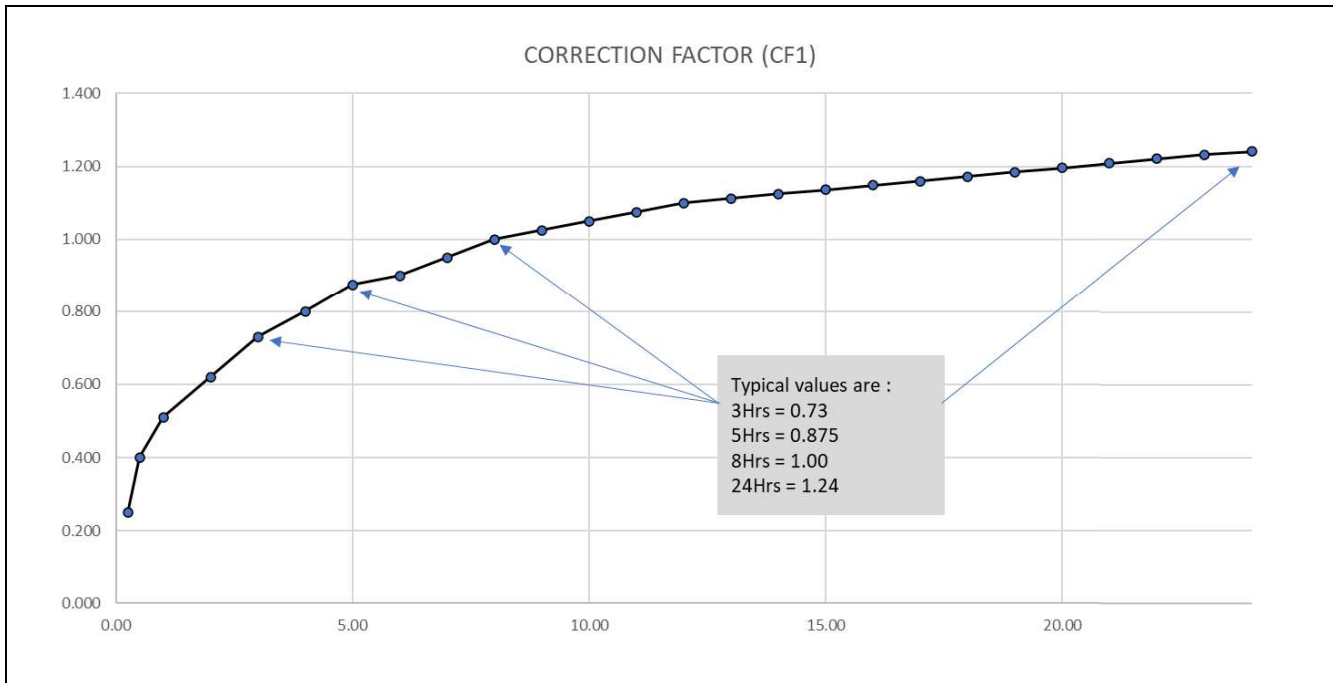
Setting correction factor CF1 and CF2:

There are two correction factors to take in consideration, CF1 is used to adjust the computation based on the target duration as Ah were provided at the 8-hour discharge rate. The second correction factor CF2 is to adjust computation based on the End Voltage such as: 1.75 or 1.88 Volts/cell. Please note that it is not possible to put zero "0" as the computation result will be zero. By default, both CF factors are set to number "1" thus, the correction factor will have no effect on the computation result.

IMPORTANT NOTICE

Setting the correction factor CF1

The CF1 enables to compensate for battery manufacture data provided at the 8-hour discharge rate and in reality, the target runtime for your application is lower or higher than 8-hours. If for example the Ah capacity is provided at the 8-hour rate and your target reserve time is 3 hours, based on the following table, the CF1 value entered must be "0.73"



Setting the correction factor CF2:

An additional correction factor can be introduced for telecom switch equipment stopping operation at higher end voltage per cell. Thus, for all end voltage per cell setup to 1.75, the CF2 shall remain at a value of 1. However, if the end voltage is established to 1.88 the CF2 must be configured to a value of 0.85.

The configurable parameters are as follow:

BATTERY RUNTIME BRES[X]

PARAMETER	DESCRIPTION	DEFAULT VALUE
Channel State	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file	None
Name	Channel identification. (Up to 40 characters)	Not programmed
Decimals digits	Value representation: Choice Between 0 and 4 digits where 4=auto	4
DC Plant Voltage reference channel	Channel providing the measured DC Plant voltage value for the computation.	Not programmed
DC Plant Current reference channel	Channel providing the measured Total Load Current value for the computation.	Not programmed
BOD trigger reference channel	Channel providing the trigger to stop the computation and initiate the countdown from the last computation value.	Not programmed
BOD Trigger state	Select if the discharge is triggered when status is in the ON or OFF position.	ON
Number of strings	Enter the quantity of battery strings associated to the specific power plants.	1
String capacity	Enter the capacity in Ah at 8-hour discharge rate	0

Enter correction factor for target duration	Use the table above to select the value corresponding to the target reserve time	1
Enter compensation factor for EOD Voltage	Select between 1 for 1.75 end voltage or 0.85 for 1.88 end voltage per cell.	1
End of Discharge (EOD) Voltage	Enter the end voltage to which the string is allowed to fall to before affecting the load (the equipment)	45Vdc

Figure 1 - Screen shot of the battery runtime channel configuration

1.5.5 PEAK CHANNELS

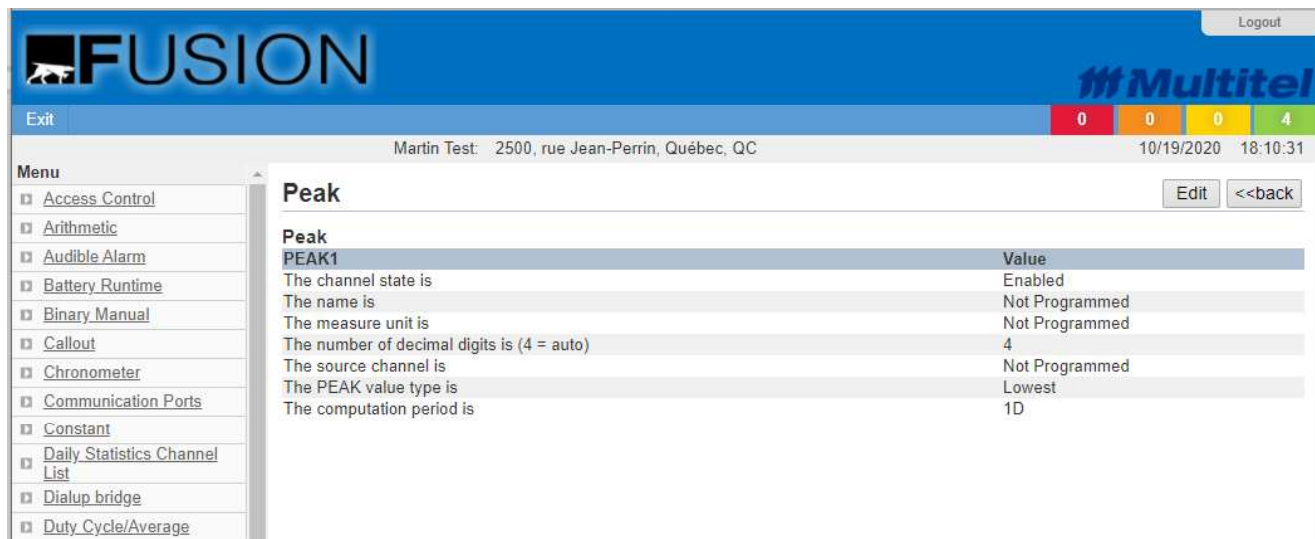
Peak channels have been added to the FUSION in order to provide the lowest or highest value from the selected reference analog or derived channel during the user configurable period of time. The peak channel can be used to capture intermittent or transient events on a monitored analog input channel or any analog derived channel. The event must be present at least 1 sec for an analog input channel and longer for Modbus or SNMP devices polled at lower frequency rates (5 to 15 minutes intervals).

For simultaneous low and high reading for a given monitored channel, the user will have to configure two (2) Peak channels accordingly. FUSION displays the peak channel value at the end of the selected interval, so the value displayed is always the high or low readings from the preceding period.

Usage Example: When FIRM Suite, the capacity management software from Multitel, aggregates data on a daily basis from the FUSION remote monitor, it will get the corresponding value at the time of the polling which is not really what's needed when performing capacity management. That value may not represent the highest value for the day as it can vary throughout the day. Therefore, a good example of the usability of the Peak channel is to monitor the target channel and retain the highest value during 24 hours, at the end of the period, the value returned by the Peak channel will be the highest value it monitored for the interval, FIRM shall be configured to poll the new channel accordingly.

PARAMETER	DESCRIPTION	DEFAULT VALUE
Channel State	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file	None
Name	Channel identification. (Up to 40 characters)	Not programmed
Units	Enter the desired units (Up to 5 characters)	Not programmed

Decimals digits	Value representation: Choice Between 0 and 4 digits where 4=auto	4
Source channel	Channel providing the measured value on which the peak value must be computed.	Not programmed
PEAK value type	Select between the "Highest" value or a the "Lowest" value to be returned.	Lowest
Computation Period	Select the period for which the computation is performed, select between 1 sec. up to 366 days. Use the following format to enter the response: xxxDxxHxxMxxS, Ex.: for daily value = enter 1D	1D



The screenshot shows the FUSION web interface. At the top, there is a blue header with the "FUSION" logo and the Multitel logo. Below the header, there is a navigation bar with "Exit" and a status bar showing "0 0 0 4". The main content area is titled "Peak" and contains a table with the following data:

Parameter	Value
PEAK1	
The channel state is	Enabled
The name is	Not Programmed
The measure unit is	Not Programmed
The number of decimal digits is (4 = auto)	4
The source channel is	Not Programmed
The PEAK value type is	Lowest
The computation period is	1D

On the left side, there is a "Menu" with various options: Access Control, Arithmetic, Audible Alarm, Battery Runtime, Binary Manual, Callout, Chronometer, Communication Ports, Constant, Daily Statistics Channel List, Dialup bridge, and Duty Cycle/Average. The status bar at the bottom shows "Martin Test: 2500, rue Jean-Perrin, Québec, QC" and the date/time "10/19/2020 18:10:31".

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CONTROL SHEET

Issue	Date MM/DD/YYYY	Description	Originator
1.0	06/10/2008	First release	S. Méthot
2.0	11/20/2008	ACO operation, binary channel operation	S. Méthot
2.1	12/04/2008	Added battery replacement information	E. Boivin
2.2	05/28/2009	Minor release	E. Boivin
2.3	06/09/2009	Add humidity sensor pin-out	E. Boivin
2.4	11/02/2010	Minor release	E. Boivin
3.0	09/27/2011	Added network security, minor software and documentation modifications	Y. Létourneau
4.0	05/25/2012	Addition of the PING and NTP functions. Addition of MODBUS modules. Major documentation modifications. Modification of software functions like RESET, DCPLANT, and TRESET. Addition of CALIBR command, Addition of SNMP v1 \ v2c \ v3 support	G. Lafond, Eng.
4.1	03/10/2012	Correction for the binary outputs connexions on Figures 13, 16, 17 and 18 (version 4.0)	Y. Létourneau
4.2	12/16/2012	HTTPS, new SNMPget modules, Enhanced HTTP(S) interface functionality, HMI views, Charts, new PID channels, major documentation modifications.	G. Lafond, Eng.
4.2	12/06/2012	Polishing	mgdent
4.3	08/20/2013	Addition of: RADIUS and Syslog protocols, improved TSTAT charts, new duty cycle channels, addition of SNMP manager selection within the callout function. Addition of an HID card access control system. Addition of 1U1S expansion module.	G. Lafond, Eng.
4.4	09/01/2014	Addition of: SSH and TCP/IP stack protocols, DSN clients, Remote Display Module, battery aging algorithm, colours for alarm severity levels, backup NTP server, derived channel Note file, communication channel de-activation, Telnet and SSH deactivation, stop counting possibility for DEL channels, DELV channels and HVAC algorithm, new RS-485 connector, FUSION wall mounting instructions.	G. Lafond, Eng.
4.6	09/30/2015	Addition of Smart Module Expansion (SMX-48BI), new signal BFDISP, configuration of the SNMPGet channel refresh rate in SYS, possibility of deactivating the alarm related loss of input power redundancy, RoHS compliancy. Final "Champ" pinout for SMX-48BI	S. Méthot, CTO.
4.7	12/18/2015	Addition of Smart Module Expansion (SMX-24AI), Dialup Bridge, new channels for SMX power faults, mouse over chart mnemonics, in line with firmware v4.75	S. Méthot, CTO.
4.8	03/25/2016	Minor adjustment to 3.8.3 and 3.8.4 quantity of channels	S. Méthot, CTO.
4.9	05/23/2016	Correction to the SMX-24AI connectors reference name	S. Méthot, CTO
5.0	07/15/2016	Added Port Forwarding protocol, $\pm 10V$ SMX-24AI front end, support of MODBUS bit fields.	S. Méthot, CTO
5.1	04/17/2017	Support two (2) DNS server addresses, increase arithmetic channels from 64 to 220 and SNMPGet channels from 16 to 24, Supports MODBUS diagnostic codes, added 2 new threshold activation types, now possible to view analog value for FUSION's binary input channels, Enabling ACHR and Group occurrence counter reset based on triggering source,	S. Méthot, CTO

<i>Issue</i>	<i>Date</i> <i>MM/DD/YYYY</i>	<i>Description</i>	<i>Originator</i>
		enable deletion of user name, Calibration in Farentheit, Broken Wire Detection for FUSION Binary input channels and removed the following functions: DC PLANT, RECTIFIER algo, EQUALIZE algo, HISTOGRAM, HVAC algo, BATTERY AGING algo and PVA function.	
5.2	06/06/2017	Visual modifications to document template	M. Greaves, Marketing
5.3	10/12/2017	Added bitwise writing function to analog output of the Generic Modbus modules, added new Lookup Table channels (4), and increased security when deactivating IP port 80, 23 and 2000	S. Méthot, CTO
5.4	11/13/2018	Added new LEAD/LAG channel (4) type, increased binary manuals from 64 to 128	M. Greaves, Marketing
5.5	01/10/2019	Correction of the humidity temperature probe drawing	E. Boivin
5.6	11/20/2020	Added addendum Fusion v4.90	L. Méthot
5.7	11/10/2021	Modifications to addendum section	S. Méthot, CTO
5.8	17/12/2021	Recent version 4.94	S. Methot, CTO
5.9	05-09-2023	Recent version 4.95	S. Methot, CTO

2 INTRODUCTION

2.1 GENERAL

The intent of this user manual is to provide information about the product characteristics, setup, installation instructions, operation and maintenance of the FUSION remote monitoring system. This manual contains active cross references (shown in [blue](#)).

FUSION is a comprehensive system designed to perform remote monitoring of many different critical system parameters found in Fixed and Mobile Communication Centers, Data Centers, Power Rooms and other critical environments.

Combining a flexible range of I/O data acquisitions, software functions, and a host of local and remote network interface, FUSION is capable of reporting and informing Engineering, Surveillance and Maintenance personnel about real time status of equipment conditions.

The product is essentially built around Telecommunications Network Standard Practices. This product is built to meet or exceed NEBS L3 requirements. Please note that our products are continuously modified to improve performance and reliability; therefore, accessories and components are subject to changes without notice. In that case, these parts or accessories are replaced by equivalent products. Contact Multitel service for the list of available accessories.

FUSION is an integral part of the Global Solution Offerings from Multitel. In an effort to enhance Power Network reliability, safety and visibility, FUSION is entirely supported by FIRM Suite™, a comprehensive Enterprise Level Management Software.

FIRM Suite™ Compatibility  **FIRMSuite®**

Together with FIRM Suite™ FUSION provides an integrated, reliable telecommunications infrastructure management solution, which will shorten response time during crisis situations and improve access to business intelligence while enabling users to improve planning and asset management with a strategic, well-documented and cost-effective process. It is an integral part of Multitel's Global Network Management Solution.

2.2 PRODUCT APPLICATION

There are several application possibilities for FUSION, most of the time they are used in Telecom Centers, Data Centers, Power Utility Substations and other locations of these types having critical infrastructure in place for the monitoring of:

- Equipment alarms/failure (RTU)
- Energy Management (PUE, DCiE, Efficiency, etc...)
- DC Power Systems (Batteries, Rectifiers, Grounding, etc...)
- AC Power Systems (AC Mains, Generators, UPS)
- Environmental Monitoring
- Hybrid Power System (Solar, Wind, Batteries, etc...)
- Branch Monitoring (AC or DC Power Distribution feeders)
- OSP Cabinets and Huts Telemetry System

FUSION uses I/O channels to monitor and control critical equipment behavior remotely from any location. Binary input channels are used for equipment failure detection and alarms such as: doors open or any change of state like the loss of AC power or generator start. Analog channels are used to perform specific measurements that can be used in FUSION for arithmetic calculation to provide real time key performance indicators. For equipment parameter measurements (such as voltage, current or temperature etc.), a sensor/transducer may be required to sense and gather this information. Example: for temperature measurement a transducer is required. However, other measurement channels (e.g. battery voltage measurement) can be cabled directly into the FUSION device or transmitted through Modbus communication or SNMPget modules.

Relay output channels are used to issue discrete alarms to a local alarm system or can be used to remotely control equipment such as turning on or off a rectifier, starting or stopping generators, etc. Data can be conveniently imported and exported to and from FUSION by using application specific devices such as Energy Meters and Power Quality meters etc. that can support MODBUS RTU and/or SNMP v1 or v2c protocols.

A whole set of software features are provided to improve various processes automation such as: HMI views for global monitoring and control, statistic and history file recording and chart visualisation, groups for automation, thresholds (pre-set warning levels), chronometers, watt-hour and PID functions for control and monitoring. Callouts for alarm notification can also be quickly and easily configured either locally through dry contact outputs or remotely through automatic callouts using a dial-up, Ethernet connection or SNMP trap.

A user-friendly HTTP(S) interface is used to access and operate the FUSION monitoring device. It provides an easy way to gain access to real-time I/O channels and derived channels statuses, statistics, graphs, HMI views and overall device configuration. The monitoring device can also be operated from: a local computer, a terminal connected to the FUSION USB port, an RS-232 serial port, a 56k-modem, an Ethernet connection or even a Cellular Modem connected to the Ethernet communication port.

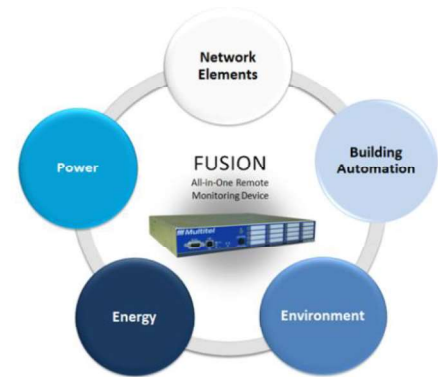
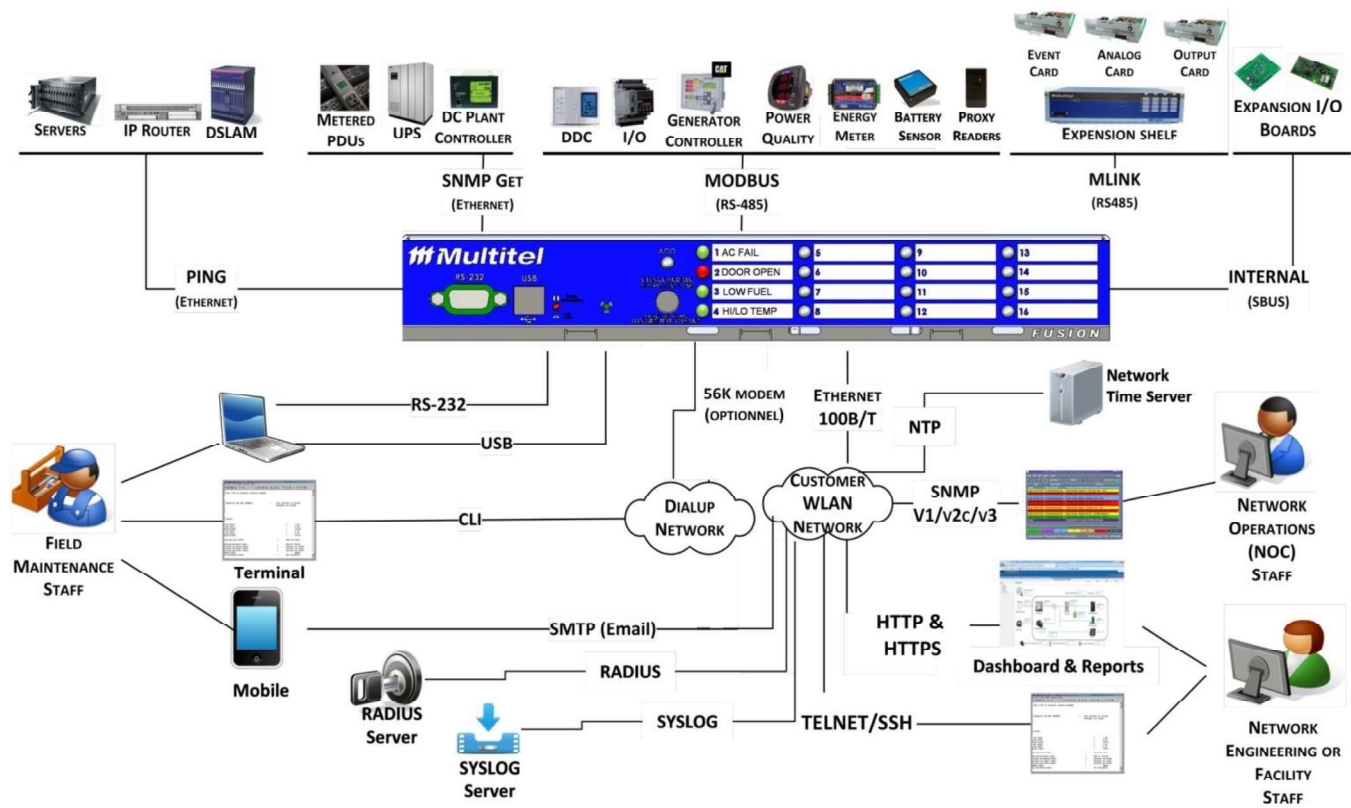


Figure 2 - Typical Application Diagram



2.3 QUICK REFERENCE INFORMATION

At Multitel we believe that the information contained in the User Manual is essential for a global understanding of the FUSION device. However, as for many high-tech products, reference to the table of contents can be laborious for users who do not require knowing everything related to the functionality of the product. Every FUSION is shipped with a laminated quick reference sheet. This sheet displays a summary of software commands, references to physical I/O connection points and other specific information. It is impossible to cover all important aspects of the product and for this reason we have included the following quick reference table that answers the most frequently asked questions addressed to our Customer Service Team.

Table 1- Frequently asked questions

Questions	Answers
FUSION system default IP address	192.168.1.1
Default TCP/IP Port	23
Serial Ports default baud rate	115200 Kb
Standard communication software interface	Ethernet Browser, Mib Browser, HyperTerminal (Ethernet, Modem, Serial)
Default user name to start a communication session	Supervisor
Default password to start a communication session	No password
Default state for the modified parameters' automatic backup	Disabled*
Enter in configuration mode (Config) (User with Supervisor access level only)	HTTP(S) interface, Config menu
Proposed fuses for protection of FUSION's power supply wiring	On line 2 A, telecom distribution panel 1 1/3 A

<i>Questions</i>	<i>Answers</i>
Proposed fuses for protection of the analog input channels' wiring directly connected to non-isolated telemetry points	On line 1/2 A
Maximum cable lengths between transducers and FUSION	See Table 93 - Maximum distances between the transducers and FUSION
Matching software (Channel mnemonics) with telemetry points	See Figure 29 to Figure 37

*Automatic Backup Mode can be activated in the **System Configuration Parameters**. (See section [4.3](#)) However, Multitel recommends keeping the use of this mode to a minimum in order to reduce the number of times data is written to the EEPROM memory.

The FUSION EEPROM memory stores the application specific configuration parameters. Increased memory activity will reduce the expected lifespan. As the FUSION architecture makes dynamic changes during normal operations there is a risk of data corruption when writing to the EEPROM. This may cause a complete re-initialisation of the parameter file. For this reason, it is also recommended to always maintain a downloadable backup copy (in standard Comma Separated Value (CSV) format) of the last configuration file.

2.4 CUSTOMER SERVICE CONTACT

Customer Service, Technical Support, Product Repair and Return, and Warranty Service

For customers in Canada and United States please call 1-888-685-8483 (418-847-2255). This number is staffed from 8:30 am to 5:00 pm Eastern Time (zone 5) Monday through Friday on normal business days. Services provided include: initiating the spare parts procurement process, ordering documents, product warranty administration and providing other product and service information.

2.4.1 Customer Training

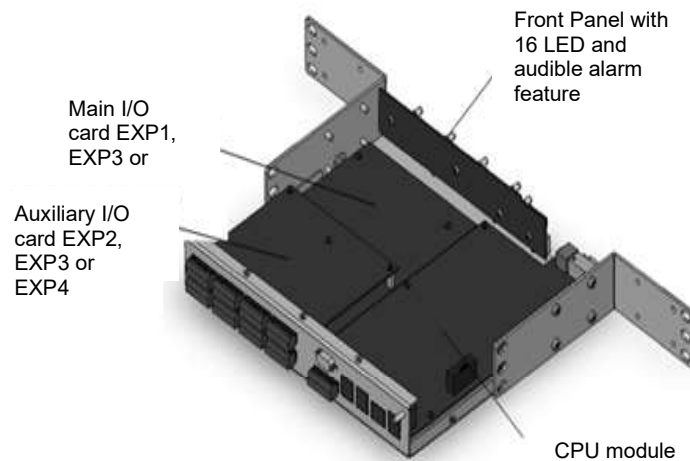
Multitel offers customer training on all of its Monitoring Device products. For information please call 1-888-685-8483 (418-847-2255)

3 FUSION COMPONENTS

3.1 INTERNAL MODULES

FUSION is built around a custom steel chassis. The chassis is protected with a high quality zinc finish in order to maintain excellent conductivity and minimize ESD damaging effects. The system comes from the factory calibrated and tested. It is recommended that only qualified technicians from Multitel (or technicians assisted by Multitel) be allowed to open the chassis for maintenance purposes. The system is powered via the corresponding plug-in connector located at the back (typically 48 volts DC). Ground PEM is located at the back of the device and should be firmly connected to Frame ground in accordance with the existing National, State or Province Electrical codes.

Figure 3 - FUSION Internal Overview



3.1.1 CPU module

The CPU module is the heart of FUSION. It is based on a MOTOROLA POWER PC microprocessor, a Real Time Clock (RTC) circuit and a watchdog circuit. The RTC ensures that the system date and time are always well-adjusted, even if the monitoring device is not powered up. The watchdog circuit ensures that the microprocessor performs properly. If the circuit detects a problem, the watchdog will reset the microprocessor. The operating configuration parameters are stored in FLASH memory (non-volatile). The CPU Module also provides the range of network interfaces for a local or remote access. The J5 connector (located on the back panel) provides A&B feed, logic ground reference and Unit Fail Alarm Relay contact. For those who are familiar with Multitel monitoring device products, this CPU module is based on the SYSTEM™ CPU III card.

3.1.2 EXP I/O cards

Multitel offers 4 different types of EXP I/O cards. Looking at Figure 3, we can see that only two EXP I/O cards can be loaded into a FUSION (loaded at the factory by qualified personnel). The cards are named EXP1, EXP2, EXP3 and EXP4. When no EXP I/O card is installed, I/O aggregation is still possible. However, in this case it is performed using the expansion shelf I/O cards, the expansion module 1U1S or MODBUS modules connected on the RS-485 subnet. Alternatively, the remote IP supporting devices via SNMP v1 and v2c can be used.

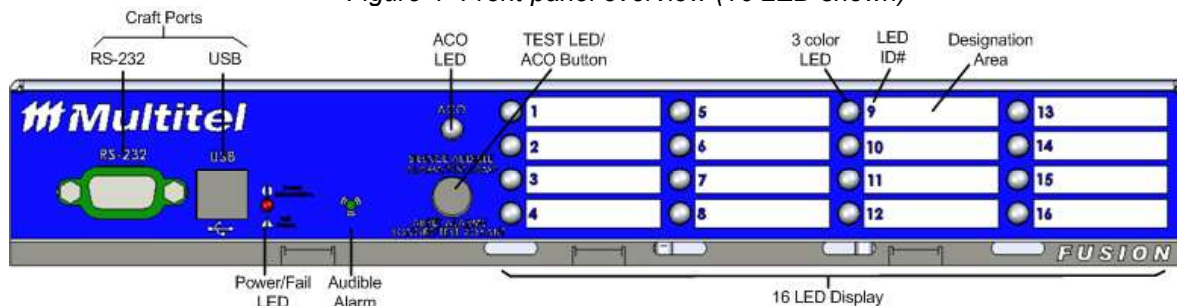
EXP1, EXP3 and EXP4 are installed in the main position. EXP2, EXP3, EXP4, EXP5 or EXP6 can be installed in the auxiliary position. A limited number of combinations between auxiliary and main cards are available for FUSION. EXP1, EXP3 and EXP4 are equipped with 16 bit analog-to-digital converters.

EXP I/O card installation and maintenance can easily be used for measuring points with the screw type modular connector located on the FUSION's back panel. The installation section of this manual provides the configuration for I/O channels electric wiring depending on different module options available.

3.1.3 Optional front panel module

For local identification, alarm diagnostic and other parameters status, FUSION is equipped with a sixteen (16) three-colour (3) LED display. A designation area for each LED provides labeling for each LED condition. Each LED colour represents a different alarm severity level.

Figure 4- Front panel overview (16 LED shown)



The following components are found on the front panel:

- A single LED for Power and Fail status indication;
- RS-232 and USB craft ports
- Piezo for audible alarms (OPTIONAL)
- Push button for LED lamp test and Audible Cut-Off (ACO); (OPTIONAL)
- LED for ACO; (OPTIONAL)
- 16 user configurable 3-colour LED and designation areas. (OPTIONAL)

Power/Fail LED

This LED provides information on the FUSION operation. At start up, the LED displays a red colour indicating that the device is booting up. This step only lasts a few seconds. When the boot up is completed, the LED will display solid green indicating that the system is ready and operating properly. Any system malfunction is indicated by a solid red or flashing red. See [section 13.2 TROUBLESHOOTING](#).

TEST Push Button (OPTIONAL)

The push button has two separate functionalities and is used to test the LEDs or to silence the audible alarm (ACO).

To test the LED, simply push and hold the button down for at least 3 seconds. After a short delay a specific test cycle will be displayed showing the following colours: green, yellow, red, blinking red. The test will cycle as long as the button is depressed.

Audible Cut-Off functionality (ACO) (OPTIONAL)

When enabled and correctly programmed, an audible alarm will ring to indicate that a new alarm condition has been generated. For Major, Minor and Critical alarms the audible alarm will sound as long as the condition is valid. It can

be stopped with the “AUDIBLE” command via the Command Line Interface or if a staff member on site pushes the ACO button.

Upon depressing the push button, the sound will stop and the ACO LED will illuminate to indicate that the audible alarm has been de-activated. If a new alarm condition is received, the audible alarm will reset and sound again and the ACO LED will turn off.

For informational level alarms the alarm will ring for approximately 1 second and the ACO LED will illuminate.

Figure 5 - FUSION front panel without and with LED



3.2 SMART MODULE EXPANSION (SMX-48BI AND SMX-24AI)

The Smart Module Expansion is a family of 2 modules, the SMX-48BI, is a unit containing a single binary acquisition card with 48 binary inputs where the SMX-24AI, is a unit offering 24 analog input channels. The modules are used for remote telemetry of telecommunication site alarms, power and environmental conditions. It communicates with the FUSION using the Modbus RTU protocol. The picture on the right shows a front view of the SMX-48BI & FUSION. This module is an addition to the already diversified and flexible FUSION's data acquisition capability.



The Smart Module Expansion has the following characteristics:

- 48Volts power supply with independant A & B feed;
- Hardened operating temperature range;
- 48 binary input channels concentrated on a "CHAMP" connector type to simplify pre-cabling or ;
- 24 analog hybrid input channels on plug-in screw type terminal blocks;
- High-speed communication via Modbus RTU protocol (115,2kbps);
- Flexible rack mounting options.

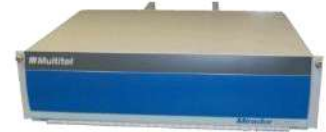
The SMX module is a stand alone module design to operate seamlessly with the FUSION and other MODBUS master station. The SMX has its own firmware called .CES file. The firmware code is uploaded using the FUSION's File Transfer application. The operating parameter setup is performed thru the FUSION native “CONFIG” menu or FUSION .CSV configuration file. The Module functions are summarized in section 4.8. and full details about the Smart Module Expansion are found in the Specific Applications section of this manual in section [8.1](#).

Please contact you Multitel sale representative for the SMX family ordering information.



3.3 EXPANSION SHELF OR EXPANSION MODULE 1U1S WITH I/O CARDS

IMPORTANT NOTICE: FUSION still supports the legacy intelligent I/O cards deployed in the expansion shelf and expansion module 1U1S. However, it is recommended to consider the various SMX modules for your today's and future I/O expansion projects.



FUSION can be set up to support a network of up to 15 I/O cards linked together using the MLINK connector located on the back panel. An additional 15 I/O cards be added to a maximum 30 I/O cards using the RS-485 serial port located on the back panel. See the FUSION Expansion User Manual for a detailed explanation of each card type (ANALOG, EVENT and OUTPUT). Each shelf supports a maximum of 5 I/O cards. Additional shelves may be installed up to 1000 feet away from the FUSION chassis. Each shelf must be powered separately from a 48Vdc power source.

For modest expansion needs, the Expansion module 1U1S provides a mean to increase the FUSION monitoring capability from its nominal 1U rack space. Each 1U1S module integrates one intelligent I/O card and can be factory installed side by side with the FUSION unit or simply used as a stand-alone remote I/O device. Multiple 1U1S modules (up to 30) can be daisy chained using the MLINK network connector at the back panel. For information concerning power specifications, I/O connexions and more details, refer to the 1U1S Expansion module Quick reference sheet.



Each card requires a specific physical location which is determined by the DIP switch setting located on the front of each card. The HTTP(S) interface feature of FUSION enables the user to configure software and enable or disable the installed modules. For additional details on the Expansion Shelf, please refer to the FUSION – Expansion Shelf User manual.

3.3.1 Analog card

ANALOG cards enable FUSION to capture measurements of any kind. The 18 available real analog channels (CxAy) can measure directly or through a transducer: DC or AC voltage, current, temperature, humidity, etc. Virtual analog channels (CxVy) can also perform calculations on the data collected.



3.3.2 Event card

EVENT cards are used to detect on-off (binary) status changes such as door open, rectifier failure, AC outage, HVAC set running, etc. Site alarm systems integration into specific applications is also available with the 48 binary input channel card (CxEy). The FUSION will easily accommodate additional EVENT cards.



3.3.3 Output card

OUTPUT cards are used to generate discrete alarms or to control (start/stop) systems or equipment by means of relay contact closure. When used for discrete alarms, the relay output channels (CxOy) are interconnected to local alarm or telemetry equipment so that alarms generated by FUSION can be sent to the Operating Support System or Surveillance Center.

The control mode is used to start and stop specific equipment remotely, manually or automatically (e.g., turning on/off rectifiers, converters and generator sets, disconnecting loads, regulating ventilation and HVAC units). Each OUTPUT card can control 32 micro relay outputs. Note that common inputs for micro relays 1 through 16 are bridged together.

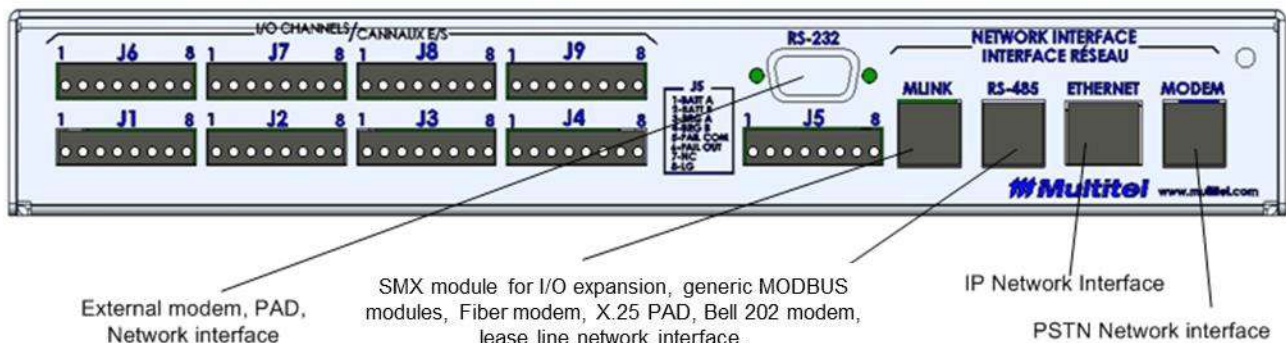


3.4 COMMUNICATION PORTS

FUSION offers a wide variety of local and remote communication ports as network interfaces for easy access to real time information. FUSION is also able to multi-task in that it can communicate with several users simultaneously while maintaining all its monitoring and control tasks. E.g. FUSION can be configured to send alarm messages through two (2) communication ports simultaneously in order to meet Fire Code requirements.

Five (5) serial ports can be managed simultaneously. However please note that the Craft USB and RS-232 located on the front panel cannot run concurrently.

Figure 6 - Communication ports overview



- One (1) EIA-232 (RS-232) serial communication CRAFT port located on the front panel
- One (1) USB Type B (USB) High Speed communication port located on the front panel
- One (1) EIA-232 (RS-232) serial communication port located on the back panel
- Two (2) EIA-485 (RS-485) serial communication port located on the back panel for I/O expansion using Multitel's SMX modules or generic MODBUS devices.
- An optional 56kpbs dial-up modem (MODEM)
- A permanent TCP/IP Ethernet port (ETHERNET)

The MODEM Port is optional, and the Ethernet port can be used by multiple users. Therefore, 10 sockets can be open simultaneously for independent access. The RS-232 rear port can be used to interface with an external modem, X.25 Network PAD, or to pass through with the legacy HVAC system, DC Plant or Generator controller equipped with a EIA-232 serial port.

4 FUSION SETUP

FUSION setup is performed through its HTTP(S) interface. The following sections use detailed configuration parameter tables to explain each of FUSION's mnemonics configuration. Mnemonics are Fusion's internal variables; all I/O channels (real or virtual), derived channels and internal software functions are associated with a specific mnemonic.

Table 2 - Mnemonics identification examples

Description	Mnemonic
Fusion's first analog input assigned to the J1 connector (refer to Figure 29 to Figure 37 for FUSION's EXP I/O module pin-out)	F1A1
MODBUS module number 1, binary input #2	M1E2
MODBUS module number 1, binary output #2	M1O2
Expansion Shelf I/O card number 5, analog input #2	C5A2
SNMPget module number 3, binary input 1	GT3E1
Ping function number 3	PING3
Callout number 5	COU5
And so on... All mnemonics are described in this present manual.	

On the FUSION HTTP(S) interface configuration parameters with the system values are shown in tables similar the ones in this manual. (Refer to section [5.1 HTTP\(S\) INTERFACE \(HTTP PROTOCOL\)](#) for a complete description of all menus) To configure any of FUSION's mnemonics click **Config** on the top menu. Changes can only be made with Supervisor level rights and the function must be enabled in order to be configured. To change a parameter click on the Edit button and enter the change in the rectangle field next to the actual parameter value. One or more changes can be made and then validated with the Apply button or to return to the previous value(s) click on the **Chan. Cancel** (Changes cancel) button. The **Apply** and **Chan.Cancel** buttons will only appear on the top right corner of the screen when a parameter is changed.

FUSION Module's configuration parameters for analog input M2A1:

To Exit configuration mode

When all the parameters are entered, validate the changes with the Apply button (this button will be available after you have changed at least one parameter)

Unit fields are passive enter any unit. One exception is for temperature fields. They are active fields, when C or F is entered; it is automatically associated with °C or °F

Fields to enter new values or selection

Return to previous status with this button before changes are saved

Parameter	Value
Enter channel state (0: Disabled, 1: Enabled or 2: None)	Enabled
Enter channel name (up to 40 chars) ('C' to clear)	AC Mains Total Power
Enter unit (up to 5 chars) ('C' to clear)	KW
Enter number of decimal digits (0 to 4, 4 = auto)	1
Enter register address (1 - 65535)	1009
Enter the reading function code (3: Holding Register 4: Input Register)	3
Enter data type	32-Bit Floating Point Number
1: 16-Bit Integer	
2: 32-Bit Integer	
3: 32-Bit Floating Point Number	
Enter multiplier	0.001
Enter offset	0

When parameter changes are completed click **Exit** in the upper left part of the screen to exit the **Config** mode. NB: when the user is in **Config** mode no other user is allowed into this mode at the same time.

4.1 USERS AND ACCESS LEVELS

Up to 10 users may be configured in the system (USER1 to USER10). The USER channels are displayed on the HTTP(S) Interface under **Derived channels** from the top menu.

For added protection, the "Viewer" and "User" access levels are disabled when the FUSION unit is shipped from the factory. The "Supervisor" access level is the only access level login initially available and the protection will be automatically de-activated when a first user is configured. If no user is configured in the system, it may be accessed with the SUPERVISOR user name and no password. In this case, there will be a mnemonic called SUSER (super user).

Each USER channel is configurable using the HTTP(S) interface by clicking on **Config** from the top menu. This can be done only by a user with Supervisor access level. All **USER[x]** have informational alarm level.

Table 3 - USER[x] configuration Parameters

Parameters	Description	Default Value
Channel State	Disabled, Enabled or None. When none is selected it does not appear in the configuration file. – When "None" is selected, the user name is deleted	None
Username	Name for the user (up to 40 chars)	
Password	The password must contain at least 8 characters, including 1 digit and 1 letter. FUSION is case sensitive for password letters. The Password field cannot be left blank.	
Access level	SUPERVISOR: Lets the user view channel values, view and change configuration parameters, download all files and activate system controls. USER: Lets the user view channel values, configuration parameters and activate certain controls (The RESET function is limited for the user). VIEWER: Lets the user view channel values, configuration parameters and activate certain controls (The RESET function is very limited for the viewer).	None
Inactivity timeout	The system will disconnect the user if there is no activity on the system for a pre-defined time. (5 to 255 min)	0
Language	The user can choose the system language. This is different from the system language chosen in the system parameter for the default system language. Select: English or French.	English
User rights	Permission to unlatch event cards and groups: Yes or No	No
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	

FUSION allows the use of a networking protocol called RADIUS. It permits a centralized user authentication management from a RADIUS server. More information concerning that option is located in section [10.5.14](#).

For network security reasons, FUSION will automatically disconnect any login attempt for 15 minutes after 3 invalid login sequences (user name and/or password). A history system log file, "**SYSLOG**", records the last 50 successful or failed login attempt including details on: port source, access protocol, access time and user name for security audit purposes.

4.2 ALARM PRIORITY LEVELS

FUSION alarms enable the user to quickly view monitoring and control points in the system. There are five priority levels:

1. CRItical: Immediate attention
2. MAJor: Follow up within a specified time
3. MINor: Next time in during regular business hours
4. INFOrmation: Additional alarm information
5. Not logged: Not recorded

“Not logged” alarms are not recorded in the unit’s history file and the channel may not trigger an alarm callout. It will however operate as if it was set to “enabled”. This is useful for intermediate channels that tend to flicker on and off quite frequently during normal operation. Setting such channels to a “Not Logged” priority ensures that the history is not polluted with unusable information.

To improve the analysis of critical situations, the first four priority levels can be associated with colours. The colours are configured in the “General System Parameters.” Please refer to section 4.3 for details. The first four priority levels are always displayed with their respective colours on the top right corner of the HTTP(S) interface. These are located on the alarm page below the severity column and inside HMI views pages. The “Not logged” priority level does not have any associated colour.

Following is an example of an “All Active Alarms” page:

The screenshot displays the 'All Active Alarms' page in the FUSION interface. The page title is 'TEMPLATE 1 HVAC R-410'. The Multitel logo is visible in the top right corner. A legend on the left indicates the color coding for alarm severity: Critical (red), Major (orange), Minor (yellow), and Informational (green). The table below lists the active alarms:

Mnemonic	Channel Name	Severity	Occurrence Counter
Q46	Modbus Module Fail	Major	1
Q48	Communication Failed	Major	1
Q47	General System Fail	Minor	1
USER2	supervisor	Informational	3
BFSYS	SYSTEM FAULT	Informational	1
BFM1	ERR: Modbus Module 1	Informational	1
BFM3	ERR: Modbus Module 3	Informational	1
BFTP	NTP Server not available	Informational	2
BFGT1	ERR: GET SNMP channel 1	Informational	1
BFPD1	ERR: PID channel 1	Informational	1
BFPD3	ERR: PID channel 3	Informational	1
BMS	HVAC turn off delay start	Informational	3

4.3 GENERAL SYSTEM PARAMETERS

General System Parameters Configuration is one of the first things required to be done when configuring FUSION using **Config** from the top menu (Supervisor access only). Select the **General System Parameters** on the left submenu area and a list of programmable parameter will be available for configuration.

Table 4 - General System Parameters Configuration

Parameters	Description	Default Value
Site/Name Location	Name that will appear in the header of the HTTP(S) interface. This name is also used for naming the FUSION's configuration file when downloading to a computer. NB: In order for the configuration file download to work correctly, when downloading the from the Web interface, the name should be limited to 16 characters.	
Site Description	Short description that will appear next to the Site/Name Location in the header of the HTTP(S) interface. This description field can be 80 characters long.	
Contact name	Refers to the person responsible for FUSION	
Network machine name	Device name that will appear in emails for machine identification	
Communication Language	Configured operating language. FUSION will respond to a command in both languages, irrespective of the configured operating language. However, it will answer the command in the configured language. Select: English or French.	English
Autosave mode for parameters	Automatic backup mode can be activated with Autosave Mode for parameter functions. However, Multitel recommends keeping the use of this mode to a minimum in order to reduce the number of times data is written to the EEPROM memory. Select: Enabled or Disabled	Disabled
WEB page refresh rate	WEB interface refresh rate is configurable between 0 and 999 seconds. 0 is equivalent to disabling the function. NB: the refresh cycle of some browsers reposition the view at the top of the page if the view is bigger than the screen. Select: 0 to 900 seconds. 0 = Disable	5 seconds
Daylight Saving Time	FUSION can automatically adjust the real-time clock for Daylight Savings Time (DST) period. Select: Enabled or Disabled	Disabled
State for NTP Protocol	Network Time Protocol enables the user to synchronize the FUSION's clock with an NTP server. Select: Enabled or Disabled	Disabled
Time Offset from UTC	Universal Time Coordinated is the primary time standard by which the world regulates clocks. The NTP server sends the UTC time to its clients. The offset depends on the time zone of the FUSION device. Select: -12 to 12 hours	0
NTP server 1	IP address or domain name for the NTP server 1. IP address format: nnn.nnn.nnn.nnn	Not Programmed
NTP server 2	IP address or domain name for the NTP server 2. IP address format: nnn.nnn.nnn.nnn	Not Programmed
Clock synchronization frequency	The clock synchronization frequency is specified by the user and synchronization is possible from once a day to every 14 days. Select: 1 to 14 days	5 days

Parameters	Description	Default Value
Reception Image State	The home page can be set to All Active Alarms or it can be an image (XMG file) uploaded to Fusion using the File Transfer/Upload menu. The uploaded image becomes the home page when the selection is Enabled. Select: Disabled or Enabled	Disabled
Reception Image Name	Configuration of the homepage HMI view (If Image State has been enabled) A list of available HMI view files is displayed for selection.	Not programmed
TELNET/SSH protocol state	TELNET and SSH protocols can be enabled and disabled by the user. If using the HTTPS protocol, Multitel recommends that TELNET is disabled to increase network security levels. Either TELNET or SSH is activated or neither of the two protocols. NB A change in SSH state will close all SSH sessions. Select: Disabled, SSH or TELNET.	TELNET
Colour associated to the Critical priority	The code for the selected colour is written in Hexadecimal. Example for the colour red: #FF0000. For standard colours, you can simply write the colour name (red or blue...) and FUSION has the code stored in its memory. Refer to section 4.3.3 for details on the colour codes.	#E51937
Colour associated to the Major priority	The code for the selected colour is written in Hexadecimal. Example for the colour red: #FF0000. For standard colours, you can simply write the colour name (red or blue...) and FUSION has the code stored in its memory. Refer to section 4.3.3 for details on the colour codes.	#F78F1E
Colour associated to the Minor priority	The code for the selected colour is written in Hexadecimal. Example for the colour red: #FF0000. For standard colours, you can simply write the colour name (red or blue...) and FUSION has the code stored in its memory. Refer to section 4.3.3 for details on the colour codes.	#FFD204
Colour associated to the Info priority	The code for the selected colour is written in Hexadecimal. Example for the colour red: #FF0000. For standard colours, you can simply write the colour name (red or blue...) and FUSION has the code stored in its memory. Refer to section 4.3.3 for details on the colour codes.	#90CF47
SNMPGet polling delay	Enter the SNMPGet channels' refresh rate, in seconds. This is used to minimize the bandwidth on IP networks. Select: 1 to 65535 seconds.	1 second
FEEDA/FEEDB lost detection state	It is possible to deactivate the alarm related to the loss of input power redundancy (fault signal BFFEED). Select: Disabled or Enabled. When this feature is disabled, loss of FEEDA or FEEDB on SMX modules will not be processed neither displayed in the alarm view.	Enabled

4.3.1 Network Time Protocol (NTP)

Two NTP servers can be for redundancy to increase reliability if one of the servers was to fail. After power up, FUSION connects automatically to the NTP server 1; if the server fails to respond, FUSION will try with server 2 an hour later. The last server to respond is kept in memory and will be used on the next synchronisation (every hour). After a power failure, then server 1 becomes the NTP server until it fails to respond.

In case of multiple failures to respond after six consecutive tries and failures between server 1 and server 2, a Binary Fail signal BFNTP is set. (I.e. the NTP server is not available). If this is the case, the synchronization frequency is automatically set to 24 hours. This is independent of the pre-set time entered by the user in **General System**

Parameters. When the connection is re-established, the synchronization frequency will return to the pre-set value and the BFNTP signal will be reset.

4.3.2 Time offset from UTC

The time offset from UTC (Universal Time Coordinated) must be specified by the user as the NTP server sends the UTC time to its clients. e.g. in Québec city where Multitel's main office is located, the offset is -5 hours for normal time and -4 hours for Daylight Savings Time. If the automatic DST feature is enabled the offset is automatically changed in the system on the correct weekend.

4.3.3 Colours associated with the Alarm priority levels

The hexadecimal code for different colour shades are widely available on the internet. A good site to find the information is www.w3schools (choose HTML colours).

Following are some examples:

Color	Color HEX
	#000000
	#FF0000
	#00FF00
	#0000FF
	#FFFF00
	#00FFFF
	#FF00FF
	#C0C0C0
	#FFFFFF

000000	000033	000066	000099	0000CC	0000FF
003300	003333	003366	003399	0033CC	0033FF
006600	006633	006666	006699	0066CC	0066FF
009900	009933	009966	009999	0099CC	0099FF
00CC00	00CC33	00CC66	00CC99	00CCCC	00CCFF
00FF00	00FF33	00FF66	00FF99	00FFCC	00FFFF

4.4 EXP I/O CARDS (HYBRID CARDS)

EXP I/O cards are installed in the FUSION chassis at the factory. Each card provides a fixed number of different I/O channel types. FUSION can be ordered with different module combinations (Table 5) Evolving customer needs are met by defining and building new modules as required.

Table 5 - Main & Auxiliary EXP I/O modules combinations

Main Card	Auxiliary Card	Analog Input	Humidity	Binary Input	Relay Output Form-C	Relay Output Form-A	Corresponding channel Mnemonics
EXP1	None	4 Hybrid	1	13	3	0	F1A1 to F1A5 F1E1 to F1E13 F1O1 to F1O3
EXP1	EXP2	10 Hybrid	1	29	3	3	F1A1 to F1A11 F1E1 to F1E29 F1O1 to F1O6
EXP1	EXP3	4 Hybrid	1	45	3	0	F1A1 to F1A5 F1E1 to F1E45 F1O1 to F1O3
EXP1	EXP4	4 Hybrid	1	41	3	3	F1A1 to F1A5 F1E1 to F1E41 F1O1 to F1O6

Main Card	Auxiliary Card	Analog Input	Humidity	Binary Input	Relay Output Form-C	Relay Output Form-A	Corresponding channel Mnemonics
EXP3	None	0	0	32	0	0	F1E1 to F1E32
EXP3	EXP3	0	0	64	0	0	F1E1 to F1E64
EXP3	EXP4	0	0	60	0	3	F1E1 to F1E60 F1O1 to F1O3
EXP4	None	0	0	28	0	3	F1E1 to F1E28 F1O1 to F1O3
EXP4	EXP4	0	0	56	0	6	F1E1 to F1E56 F1O1 to F1O6

4.4.1 EXP card configuration

Although EXP I/O card are factory configured, users with Supervisor level access can enable or disable the installed cards. Select **Config** from the top menu and choose **Fusion - I/O Channels** on the left submenu. Click on **F[x]** to enable or disable the card. A list of channels will be displayed on the HTTP(S) interface for enabled cards.

Table 6 - F[x] Configuration Parameters

Parameters	Description	Default Value
Module State	Disabled, Enabled or None. When none is selected it will not appear in the configuration file.	None
Reset Occurrence Counter	The user can reset the occurrence counter associated with the BFF1 signal. This is a fail signal setting if trouble is found in any of the modules.	No

4.5 ANALOG INPUT CHANNELS (EXP1, EXP2 AND SMX-24AI)

Analog channels used for different types of measurements. Some of these measurements may need a specific transducer to convert specific process "phenomenon" into an analog value. Other measurements (e.g. battery voltage) will not require a transducer. These can be wired directly to an analog channel. FUSION is designed to easily and efficiently adapt to perform a wide variety of measurements with its hybrid front-end analog input channels. For each analog input channel, the front-end can be user selectable depending on the measurements signal requirement. (See Table 7)

1. $\pm 50\text{mV}$ for shunt DC current measurement
2. Temp for temperature measurement
3. 0-65Vdc for CC voltage measurement and $\pm 65\text{Vdc}$ for the SMX-24AI
4. 23Vrms for AC voltage measurement
5. 0-10Vdc for CC voltage measurement and $\pm 10\text{Vdc}$ for the SMX-24AI
6. 1.4Vrms for AC current measurement





Analog channels are found on the EXP1, EXP2 and SMX-24AI module, they share the same electronic design and all channels offer the same technical specification and operating parameters setup. The only exceptions are as follow:

- F1A5 which is restricted for Humidity measurements
- 65Vdc & 10Vdc channel front-end on the EXP1 and EXP2 are unidirectional where on the SMX-24AI the are polarized, meaning $\pm 65\text{Vdc}$ and $\pm 10\text{Vdc}$.

NB: Ambient humidity level measurement is done using a specific transducer available at Multitel:

Table 7 - Main & Auxiliary hybrid analog input channel types

MEASUREMENT TYPE	FRONT END	TRANSDUCER	SCALE
	0-65Vdc	Not applicable – For FUSION only	65

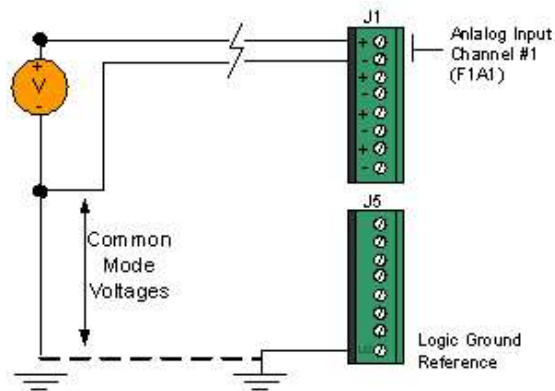
DC voltage such as, DC system voltage, 12Vdc battery jar, Generator start battery voltage, etc..	$\pm 65\text{Vdc}$	Not applicable – For SMX-24AI only	65
DC voltage from 2V cells.	0-10Vdc	For FUSION only	10
	$\pm 10\text{Vdc}$	For SMX only	10
Used for 10V output signal from various types of transducers Liquid level, DC or AC Current	10Vdc 	Various third party transducers	Transducer value
DC Current for branch circuit monitoring of PDF and DC distribution feeds, individual battery string charging & discharging current, etc...	$\pm 50\text{mv}$	Shunts	Shunt value
	10Vdc for 0-4Vdc CT 	DC Current Transducer ($\pm 50\text{A}$)	125
		DC Current Transducer ($\pm 100\text{A}$)	250
		DC Current Transducer ($\pm 250\text{A}$)	625
		DC Current Transducer ($\pm 500\text{A}$)	1250
AC Voltage on single phase 120/240 Vac or three phase 208 Vac systems using SDTA from Multitel	23Vrms is specific for SDTA	SDTA-01 (240Vac)	2680
		SDTA-02 (240Vac / 600Vac)	2680 / 6700
AC Current using CT providing 0-333mVrms output signal.	1.4Vrms for 0.333mV AC Current CT 	AC Current Transformer 50A	595
		AC Current Transformer 100A	1189
		AC Current Transformer 200A	2378
		AC Current Transformer 400A	4757
		AC Current Transformer 600A	7135
		AC Current Transformer 1500A	17835
		AC Current Transformer 2000A	23783
Ambient, indoor, Exterior Temperatures	Temp 	Temperature Probes (M-4103, M-4107, M-4109, M-4111, M-4115)	120
Ambient relative humidity	Humidity	Humidity Probe (M-4109) – FUSION F1A5 Only	100
Float Charging Current for thermal runaway	$\pm 50\text{mVdc}$	FCCP-01 (Float Charging Current Probe)	5

When using a combination of SMX modules, MODBUS modules and SNMPget modules the capacity of the FUSION device can be expanded to hundreds of Analog Input Channels per installation. Each SMX module is configured as M[x] module in the **Module** submenu. Each ANALOG card is configured as a C[x] module in the **I/O Cards** submenu. This manual covers MODBUS modules connected on a RS-485 communication bus and SNMPget modules communicating via SNMP.

For detailed information related to the SMX-24AI analog input channels, see the Specific Applications section of this manual in section [8.1](#).

4.5.1 Analog input channel operation (hybrid)

Each analog input channel is wired to the back panel. FUSION is continuously monitoring the voltage level between each analog channel and its reference value (see diagram below). One or more software thresholds can be associated to each channel in order to generate alarms or enable controls. Section 8.3THRESHOLDS (1500)



Respect the polarity for each analog input channel for values to display correctly. Pay attention to -48Vdc voltage measurements

4.5.2 Analog input channels configuration

The analog input channels are displayed on the HTTP(S) interface under the **I/O Channels** top menu.

To configure FUSION I/O channels using the HTTP(S) interface click on **Config** from the top menu (Supervisor access only) and choose **Fusion - I/O Channels** on the left submenu. Click on the **FxAy** channel to be configured. A list of programmable parameters will be displayed.

To configure the SMX-24AI channels using the HTTP(S) interface click on **Config** from the top menu (Supervisor access only) and choose **Module** on the left submenu. Click on the desired **M(x)** SMX-24AI to be configured and select the desired channel from the list. A list of possible programmable parameters will be displayed.

Table 8- FxAy and MxAy Configuration Parameters

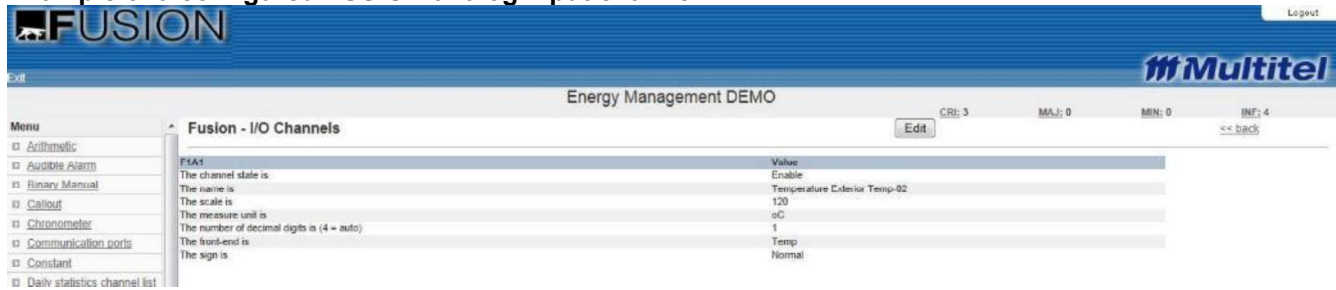
Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Scale	Scaling factor, Select: 1 to 65 535 (16 bit)	80
Measure unit	Measurement unit, up to 5 characters (e.g. Watt, kWatt). Unit fields are passive enter any required value. Exception: temperature fields as these are active fields. When C or F is entered it is automatically associated with °C or °F. FUSION is in °C by default.	Not Programmed
String associated to each code (reserved for Modbus modules)	List of strings associated to each code, sperated by coma « , ». The first string corresponds to code « 0 », second to code « 1 » and so on.	Not Programmed
Number of decimal digits	Analog value representation: Choose between 0 and 4 digits where 4=auto	4
Front-end	Front-end type: Shunt ($\pm 50\text{mVdc}$), Temp, 0-65Vdc, 23Vrms, 0-10Vdc or 1.4Vrms ($\pm 65\text{Vdc}$ and $\pm 10\text{V}$ for the SMX-24AI)	Shunt ($\pm 50\text{mVdc}$)
Sign	Polarity: Normal or Inverted	Normal
Offset (reserve for the SMX-24AI)	The channel offset the by default zero value. The range can be configured between: ($-3.40282\text{e}+38$ - $3.40282\text{e}+38$)	0



IMPORTANT:

- Even if mnemonics are called FxAy, the “x” value can only be set to 1. The analog channel mnemonics in FUSION are F1Ay, where “y” corresponds to the analog input channel.

Example of a configured FUSION analog input channel:



Using the SMX modules, Expansion Shelves, ANALOG Cards, MODBUS modules and SNMPget modules the user can expand the FUSION's default capacity from 4, up to more than 1500 analog input channels per installation. Each SMX module is configured as a **M[x]** module in the **Module** submenu. For detail wiring instruction for the SMX-24AI module see section [8.1.10](#). ANALOG cards are configured as a **C[x]** module in the **I/O Cards** submenu.

MODBUS modules connected on a RS-485 communication bus and SNMPget modules communicating via SNMP are covered in this manual.

4.6 BINARY INPUT CHANNELS (EXP1, EXP2, EXP3, EXP4 AND SMX-48BI)

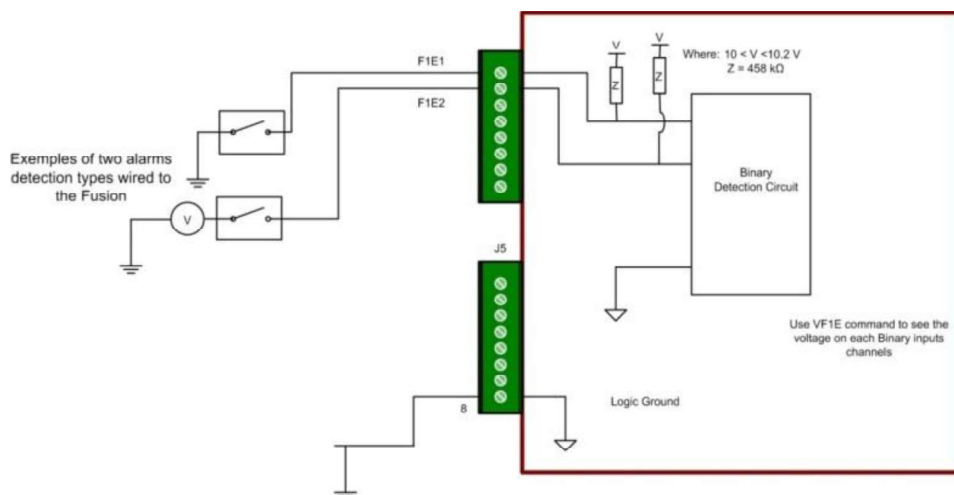
Different terminology is used to named Binary input channels, such as: Dry-C, Discrete, Alarm and Event Channels. These channels are used to detect on-off status changes. (E.g. open door, rectifier failure, AC outage, HVAC on etc.) Most monitored equipment/system have the ability to operate a relay contact to generate a dry contact alarm. FUSION's binary input channels are use to detect that change in equipment or system operation.

Usually, a relay contact sends a ground signal to a specific binary input channel and FUSION detects the ground signal and triggers an action according to pre-programmed conditions. For some types of detections (e.g. smoke/fire, open door, water presence etc.) transducers should be used to perform these tasks. A wide variety of sensors, probes and transducers are available directly from Multitel.

Binary input channels are found on the FUSION's EXP1, EXP2, EXP3, EXP4 and SMX-48BI module. Each binary input channel is individually programmable. Grouping functions, alarm severity distinction, history log files as well as many other features makes FUSION a powerful tool for managing telecommunication site infrastructure equipment alarms. FUSION and SMX-48BI binary input channel share the same electronic design, technical specification and operating parameter setup.

4.6.1 Binary input channel operation

FUSION continuously monitors the voltage level between each Binary Input Channel and the Logic Ground Reference. When the voltage is within the "voltage level range" of the selected "activation level", the Binary Input Channel state will change and its corresponding triggering source (mnemonic, FxEy) will turn on (see diagram below). Refer to section 12.5 Wiring Binary Input Channel for more details.



FUSION provides between 13 and 64 binary input channels depending on installed EXP I/O modules. The mnemonics are named 'FxEy', where "y" corresponds to the binary input channel. Just like for analog channels, the "x" value of the mnemonic is only allowed the value of 1. In turn, the SMX-48BI offers 48 binary input channels sharing the same characteristics. For detail wiring instruction for the SMX-48BI module see section [8.1.11](#).

4.6.2 Binary input channels configuration (Dry Contact Input)

The binary input channels are displayed on the HTTP(S) interface under the **I/O Channels** top menu.

To configure parameters associated with the corresponding FUSION's binary input channel (FxEy), click on **Config** from the top menu (Supervisor access only) and then choose **Fusion - I/O Channels** on the left submenu. The **F[x]** module has to be enabled in order to view the available channels. Click on the **FxEy** channel to be configured. A list of programmable parameters will be displayed for configuration.

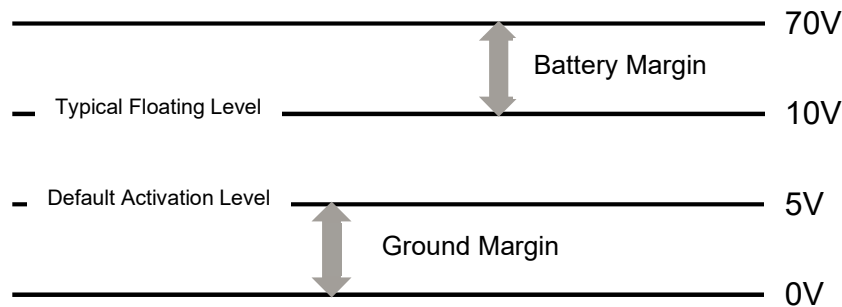
To configure parameters associated with the corresponding SMX-48BI binary input channel (MxEy), click on **Config** from the top menu (Supervisor access only) and then choose **Module** on the left submenu. The **M[x]** module has to be enabled in order to view the available channels. Click on the **MxEy** channel to be configured. A list of programmable parameters will be displayed for configuration.

Table 9 - FxEy & MxEy Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each Binary Input Channel can be associated with an alarm level type: Not Logged, Informational, Minor, Major or Critical.	Not Logged
Activation delay	Pre-set time used to delay the input activation, it starts counting on a rising edge of the input. Select: 0 to 999 seconds	0s
Deactivation delay	Pre-set time used to delay the input de-activation, it starts counting on a falling edge of the input. Select: 0 to 999 seconds	0s
Voltage level	Voltage input level. Select: 0 to 70 Volt Absolute	5V
Activation level	The activation level enables the user to select between Ground or Battery levels. Refer to the Activation Level margins figure below this table for details.	Ground

Parameters	Description	Default Value
Operating mode	The operating mode enables the user to select between Not latched and latched input channel operation. If the latch option has been selected (once the input is activated) it will remain in this state until a USER with the right permission level enables unlatching of the input.	Not latched
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	No

Activation Level margins:



Each Binary Input Channel is terminated on the FUSION's back panel. With this type of channel, an alarm can be generated between the equipment or sensor when the FUSION binary input channel goes open. Further support is available from Multitel's application engineering department.

Example of a configured FUSION binary input channel:



Using the SMX modules, Expansion Shelves, EVENT Cards, MODBUS modules and SNMPget modules the user can expand the FUSION's default capacity from 13, up to more than 3000 Binary Input Channels per installation. Each SMX module is configured as a **M[x]** module in the **Module** submenu. For detail wiring instruction for the SMX-48BI module see section 8.1. EVENT cards are configured as a **C[x]** module in the **I/O Cards** submenu. MODBUS modules connected on a RS-485 communication bus and SNMPget modules communicating via SNMP are covered in this manual.

4.7 BINARY OUTPUT CHANNELS (EXP1, EXP2 AND EXP4)

Up to a total of six binary output channels (relay) are included depending on the FUSION model. The Binary Output Channels are used to generate discrete alarms or to control (start/stop) systems or equipment operations

using internal relay contact closure. The relay operation can be triggered manually or with a user-programmable triggering equation.

When used for discrete alarms a Binary Output Channel is interconnected to a local alarm or telemetry equipment. This enables the alarms generated by FUSION to be communicated to the Network Operations or Surveillance Centres.

Binary Output Channels can be used to remotely start and stop other equipment (manually or automatically). Applications vary widely; from turning rectifiers, converters or generators on or off or disconnecting loads in solar applications or regulating ventilation or HVAC units.

4.7.1 Binary output channel operation

Each Binary Output Channel controls a micro relay located on the I/O modules and can be associated with an alarm severity type (Minor, Major or Critical). When a channel status is displayed, the severity level is also displayed, indicating alarm urgency. The alarm level type "Not Logged" will operate as it was set to "enabled" but no event will be recorded in the History File.

Binary Output Channels are terminated on the FUSION's back panel. In order to facilitate relay contacts wiring all relay "common" contacts are bridged together internally.

Available relay contacts:

- Main I/O module = 3 FORM "C" relays (N.O. and N.C. contacts are available for each relay)
- Auxiliary I/O module = 3 FORM "A" relays (only N.O. contacts available for each relay)

The Binary Output Channel mnemonics are named **FxOy**. The "x" value of the mnemonic is can only be set to 1. The "y" value corresponds to the Binary Output Channel (1 to 3 for the Main I/O module and 4 to 6 for relays on the Auxiliary I/O module).



FUSION uses micro relays which should be protected when connecting to large inductive loads such as a solenoid or a control relay coil with the use of a diode. Otherwise, the equipment may be reset and/or damaged.

To configure a manually controlled output, Binary Manual channels can be used as triggering source.

4.7.2 Binary output channels configuration

The binary output channels are displayed on the HTTP(S) interface under the **I/O Channels** top menu.

To configure parameters associated with the corresponding binary channel (FxOy), click on **Config** from the top menu (Supervisor access only) and then choose **Fusion - I/O Channels** on the left submenu. In order to view available channels the **F[x]** module has to be enabled. Click on the **FxOy** channel to be configured. A list of programmable parameters will be displayed.

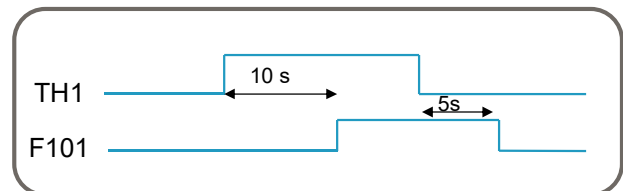
Table 10 - FxOy Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When None is selected it does not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each Binary Output Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Not Logged

Parameters	Description	Default Value
Activation delay	Pre-set time used to delay the output activation, it starts counting on the triggering source rising edge. Select: 0 to 999 seconds	0
Deactivation delay	Pre-set time used to delay the output de-activation, it starts counting on the triggering source falling edge. Select: 0 to 999 seconds	0
Operating mode	The operating mode Enables the user to select between Triggered and Pulsed operation. Functionality of these modes of operation is explained in sections 3.7.3 and 3.7.4.	Triggered
Pulse duration	This parameter is available only if the pulse mode has been selected. Select: 1 to 999 seconds.	1
Triggering source	Triggering source used to activate the output channel	Not Programmed
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	No

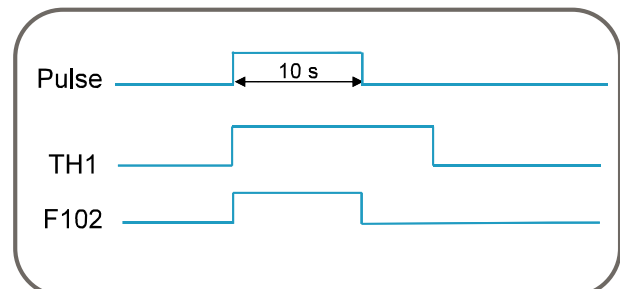
4.7.3 Triggered mode

The output channel becomes active when the triggering equation or triggering source is TRUE (valid). It will be delayed by the activation delay value and extended by the deactivation delay pre-set time. E.g. If TH1 is the triggering source activation delay is 10 seconds and deactivation delay is 5 seconds. The output channel signal F101 would look like:

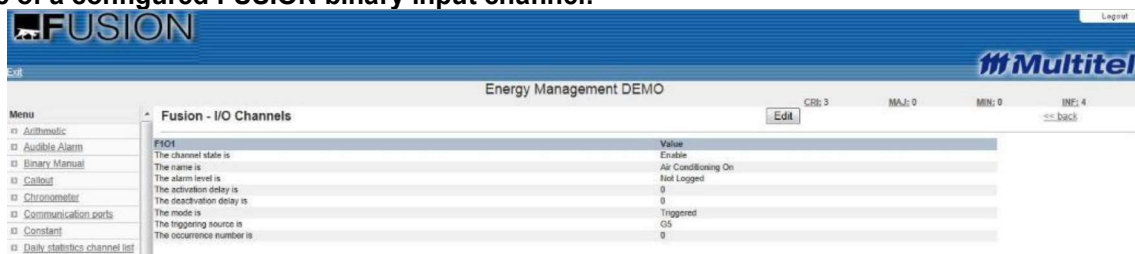


4.7.4 Pulsed mode

The output channel becomes active if the triggering source is active. It will stay ON as long as the pre-set pulse duration has not expired. If the triggering source state stays valid for a shorter period than the pulse duration, the output will stay valid for the pulse duration pre-set time. E.g. If TH1 is the triggering source; the pulse duration is 10 seconds the output channel signal F102 would look like:



Example of a configured FUSION binary input channel:



4.8 SMX AND GENERIC MODBUS MODULES (64)

FUSION is capable of acquiring data from remote devices (referred to as modules in this manual) using the standard MODBUS RTU protocol over its MLINK or RS-485 communication port or both simultaneously. Up to 64 modules can be connected to a single FUSION, a maximum of 32 modules for each MLINK and RS-485 port. The MODBUS modules can be networked between the two ports as long as there is no Multitel Expansion Shelf configured. For more detailed information on the MODBUS RTU protocol, go to www.modbus.org.

There are two types of MODBUS modules supported by FUSION: the “SMX modules” and the “Generic modules”. Generic modules are modules made by a third party manufacturer, commercially available such as : Energy meters, Power Quality meters, Fuel Management systems, VFD pumps, DDC controllers, intelligent thermostats, intelligent sensors etc. If you are uncertain about the compatibility between the FUSION and existing generic module, contact your Multitel representative who will inform you on the list of supported modules and qualification services for new modules not yet qualified.

The SMX modules comes in two (2) flavor, the SMX-48BI and SMX-24AI. All module types can be networked together to a single FUSION using the open standard MODBUS RTU protocol. These SMX modules configuration is discussed in following section [3.8.3](#) and detail SMXP modules si in section [8.1](#). Their configuration is included in this present section because they are considered Modbus modules.

SMX module do not require any MODBUS registry configuration, once configured, SMX analog and binary input channels are processed like any other FUSION I/O channels. Thresholds can be setup, statistics and history recorded, etc.

FUSION can be configured with up to 32 MODBUS modules on each of the MLINK and RS-485 ports. Each module has a unique address for identification. In FUSION, the SMX and Generic modules are configured as **Modules**. The configuration setting differs between when selecting the module type: SMX-24AI, the SMX-48BI or the Generic modules.

4.8.1 Generic module configuration

For each generic module, there is a possibility of associating 28 analog input channels (**MxAy**), 16 binary input channels (**MxEy**), 8 binary output channels (**MxOy**) and 4 analog output channels (**MxRy**). NB: Generic MODBUS modules channels do not have a latching option.

To configure parameters associated with **M[x]**, click on **Config** from the top menu (Supervisor access only) choose **Modules** on the left submenu and then click on the module **M[x]** to be configured. A list of programmable parameters will be displayed.

Table 11 – M[x] Configuration parameters for a generic module

Parameters	Description	Default Value
Module state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Module identification (Up to 40 characters)	
Slave ID	Slave ID is the identification number of the slave module (Modbus module). Select: between 1 and 255	1
Port	Port Selection to which the module will be connected. Select: RS-485 Back Port or MLINK Port	RS-485 Back Port
Retry	The number of retry enables to the FUSION to retry a number of times when communication fails. The number is configurable between 1 and 99. After the retry number the specific module is marked failed and will be retried from time to time.	4

Parameters	Description	Default Value
Module type	Choose the module type you are configuring. Select: GEN, SMX-48BI or SMX-24AI. For a generic Modbus module, select GEN.	GEN
Time out	The Time out parameter is used to check on the slave response time. If the device fails to respond within the pre-set time for 3 consecutive try or if FUSION detects 3 communication errors in data transfer a Binary Fail signal corresponding to the module number will be activated (BFM[x]). Select: 1 to 50*0.1s (100 ms to 5 s)	100 ms
Register order	Some manufacturers implement MODBUS RTU in their equipment to store and transmit the higher byte first followed by the lower byte rate. Others store and transmit the lower byte first. Refer to the specific device instruction manual to get the right information in order to configure FUSION accordingly. Most significant register = lower address or Most significant register = higher address	Most significant register = lower address
Register base address	This selection depends on the device's addressing mode. E.g. The Direct logic mode uses the given address because the addressing range starts at zero. The 584/984 addressing mode uses the given address minus 1 because the addressing range starts at 1 instead of 0. Refer to the Modbus device instruction manual for register addressing information. Select the given address or subtract 1 from given address.	Subtract 1 from given address
Enter silent before sending request	This parameter is used to compensate for the longer processing time needed for some types of modules. The setting of this parameter depends on the module in use and the subnet configuration. It is a delay imposed between the moment the request should have been sent and the sending request. Without this parameter adjustment, a slower module may go into Time out because it does not have time to process the request. Select: 0 to 100, in 0.01 seconds.	0

Example of a generic module configuration:

The screenshot displays the FUSION configuration software interface. At the top, the 'FUSION' logo is on the left and the 'Multitel' logo is on the right. Below the logos, the unit identifier 'MTQC175-2500: Multitel Demo unit located at 175-2500 Jean-Perrin Street, QC G2C1X1' is shown. On the right side of the header, there are status indicators for CRI (7), MAJ (1), MIN (2), and INF (22), along with a '<< back' button. The main area is divided into a 'Menu' on the left and a 'Modules' section on the right. The 'Menu' includes options like Access Control, Arithmetic, Audible Alarm, Battery Aging, Binary Manual, Callout, Chronometer, Communication Ports, Constant, Daily Statistics Channel List, and Dialup bridge. The 'Modules' section shows a table for module 'M2' with the following parameters and values:

Parameter	Value
The module state is	Enabled
The name is	AC Mains
The slave ID is	2
The port is	MLINK Port
The number of retry is	4
The module type is	GEN
The time out is	1
The register order is	Most significative register = higher address
The register base address is	subtract 1 from given address
The silent (in 0.01 sec) before sending request is	0

4.8.2 Binary Fail Signal associated with the generic modules

A Binary Fail signal **BFM[x]** will be triggered if the MODBUS module malfunctions. Two different statuses for the module or channel can be displayed. The “NA” status indicates a communication problem (i.e. the module is not available) E.g. if the module fails to respond (see time out parameter) or if the MODBUS sub-net is disconnected. If the module fails to respond the “Enter silent before sending request” parameter can be modified to resolve this issue.

The “ERR” status indicates a trouble with one or more configuration parameters. All these troubles will trigger a **BFM[x]** signal, x will represent the module number.

4.8.3 Generic module’s analog input channels configuration

The analog input channels are displayed on the HTTP(S) interface under the **I/O Channels** top menu.

Each module’s analog input channel is individually programmable. To configure parameters associated with the **MxAy** mnemonic, click on **Config** from the top menu (Supervisor access only) and then choose **Modules** on the left submenu. Select the module to be configured. The module must be enabled to display the analog input channels available for configuration. Select one of the 28 **MxAy** channels and a list of programmable parameters will be displayed.

Table 12 - MxAy Configuration parameters for a generic module

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Measure unit	Measurement unit, up to 5 characters (ex: Watt, kWatt). Unit fields are passive. Any unit can be entered. One exception is for temperature fields. They are active fields so when C or F is entered it is automatically associated with °C or °F.	Not Programmed
Number of decimal digits	Selection for the analog value representation: Between 0 and 4 digits, 4=auto	4
Bit Mask	Bit mask is used to read and extract a specific bit from the Modbus register. FUSION considers first bit to be 0. The bit mask must be a value specific between 0 and 15.	None
String associated to each code	List the string associated to each code, separated by coma “,”. First string corresponds to code “0” and second string to code “1” and so on.	Not programmed
Register address	Module memory location for the analog value to be read. Select: 1 to 65 535 (16 bit)	1
Reading function code	The Input registers and Holding registers are both integer registers. In the MODBUS module they are assigned different address areas. Refer to the device instruction manual for more information. Select: Holding Register or Input Register	Holding Register
Sign	The integer value can be used as a Signed integer or Unsigned integer.	Signed Integer
Data type	Specification for the numerical data storage. Select: 16-Bit Integer, 32-Bit integer or 32-Bit Floating Point Number	16 Bit Integer
Multiplication factor	The multiplication factor is used to adapt the acquired value to the configured unit (e.g., there is a factor 1000 between watt and kilowatts). Select: -3.40282 e ³⁸ to 3.40282 e ³⁸	1
Channel Offset	The offset value is applied to balance or counterbalance any residual value provided by the Modbus device input source. Select: -3.40282 e ³⁸ to 3.40282 e ³⁸	0

One or more software thresholds can be associated to each analog channel in order to generate alarms and enable controls. Refer to [section 8.3 THRESHOLDS](#) (1500).

Example of a generic module's analog input channel configuration:

MTQC175-2500: Multitel Demo unit located at 175-2500 Jean-Perrin Street, QC G2C1X1

Logout

8 CRI: 1 MAJ: 2 MIN: 31 INF: << back

Menu	Modules	Value
Access Control	M2A1	
Arithmetic	Enter channel state (0: Disabled, 1: Enabled or 2: None)	Enabled
Audible Alarm	Enter channel name (up to 40 chars) ('C' to clear)	AC Mains Total Power
Binary Manual	Enter unit (up to 5 chars) ('C' to clear)	kW
Callout	Enter number of decimal digits (0 to 4, 4 = auto)	1
Chronometer	Enter bits for the mask used to extract value ((bit - bit), bit is a value between 0 to 15, 'C' to clear)	None
Communication Ports	Enter strings associated to each code ('C' to clear) Use comma "," to separate strings, first string links to code 0, second string to code 1, ... - Your entry will only be visible after using the "Apply" button.	Not Programmed
Constant	Enter register address (1 - 65535)	1009
Dialup bridge	Enter the reading function code (3: Holding Register 4: Input Register)	3
Duty Cycle/Average	Enter sign (0: Normal, 1: Inverted)	Normal
EMAIL Protocol	Enter data type 1: 16-Bit Integer 2: 32-Bit Integer 3: 32-Bit Floating Point Number	32-Bit Floating Point Number
Front Panel LEDs	Enter multiplication factor (-3.40282e+38 - 3.40282e+38)	0.001
Fusion - I/O Channels	Enter channel offset (-3.40282e+38 - 3.40282e+38)	0
General System Parameters		
Groups		
I/O Card		
Links		
Modbus Display		
Modules		
PID		
Ping		
Programmable Delay		
Programmable Views		
RADIUS Protocol		

4.8.4 Generic module's binary input channels configuration

The binary input channels are displayed on the HTTP(S) interface under the **I/O Channels** top menu.

Each module's binary input channel is individually programmable. To configure parameters associated with the MxEy mnemonic, click on **Config** from the top menu (Supervisor access only) and then choose **Modules** on the left submenu. Select the module to be configured. The module has to be enabled in order to see the binary input channels available for configuration. Then select one of the 48 **MxEy** channels. A list of programmable parameters will be displayed.

Table 13 - MxEy Configuration parameters for a generic module

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification (Up to 40 characters)	Not Programmed
Alarm Level	Each Binary Input Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Not Logged
Bit Mask	Bit mask is used to read and extract a specific bit from the MODBUS register. FUSION considers first bit to be 0. The bit mask must be a value specific between 0 and 15.	None
Register address	In MODBUS modules, coil and discrete input are assigned different address areas. Refer to the MODBUS module instruction manual for more information. Select: 1 to 65 535	1

Parameters	Description	Default Value
Reading function code	A single bit physical output is read/write and named a “Coil” and a single bit physical input is read only and named a “Discrete Input”. The Bit Holding registers are read/write and Bit Input registers are read only. These 4 types of binary inputs are assigned different address areas in the module. Refer to the device instruction manual for more information. Select: Coil , Discrete Input , Holding Register and Input Register .	Coil
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	

Binary mnemonic **MxEy** can be used as a triggering source to generate automatic callouts, activate front panel LEDs, operate output relays, start a timer, etc.

Example of a generic module's binary input channel configuration:

Module	Value
M2E1	Value
Enter channel state (0: Disabled, 1: Enabled or 2: None)	Enabled
Enter channel name (up to 40 chars) ('C' to clear)	Not Programmed
Enter the alarm level (0: Not Logged, 1: Informational, 2: Minor, 3: Major, 4: Critical)	Info
Enter bits for the mask used to extract value ((bit), bit is a value between 0 to 15, 'C' to clear)	None
Enter register address (1 - 65535)	1
Enter the reading function code (1: Coil 2: Discrete Input 3: Holding Register 4: Input Register)	1
Reset occurrence counter (Y/N)	

4.8.5 Generic module's analog output channels configuration

The analog output channels are displayed on the HTTP(S) interface under the **I/O Channels** top menu.

Each module's analog output channel is individually programmable. To configure parameters associated with the **MxRy** mnemonic, click on **Config** from the top menu (Supervisor access only) and then choose **Modules** on the left submenu. Click on the module to be configured. The module has to be enabled in order to display the analog output channels available for configuration. Then select one of the 4 **MxRy** channels. A list of programmable parameters will be displayed.

The analog output channel enables multiple type of control applications such true analog behavior or binary for turning on/off devices. The analog output channel support single or multiple writing in MODBUS holding registers. This enables to manage devices that are using variation of the MODBUS communication protocol. For example, you will get control over Invertek Drive Optidrive™ variable frequency drives, Temco Controls T3 I/O modules and Liebert® IntelliSlot™ Unity™ Cards.

Table 14 - MxRy Configuration parameters for a generic module

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed

Parameters	Description	Default Value
Measure unit	Measurement unit up to 5 characters (ex: Watt, kWatt). Unit fields are passive. Any unit can be entered. One exception is for temperature fields. They are active fields so when C or F is entered it is automatically associated with °C or °F.	Not Programmed
Number of decimal digits	Selection for the analog value representation: Between 0 and 4 digits where 4=auto	4
Register address	Module's memory location for the analog value to be written. Select: 1 to 65 535 (16 bit)	1
Reading function code	The Input registers and Holding registers are both Integer registers. In the MODBUS module, they are assigned different address areas. Refer to the device instruction manual for more information. Select: Holding Register or Input Register	Holding Register
Writing function code	Enter the writing function code (6: Preset Single Register 16: Write Multiple registers)	6
Default output value	Output value used when no link channel is connected. Select: -3.40282×10^{38} to 3.40282×10^{38}	0
Link channel type	The channel link to the module can be an Analog output or Binary output type. When Analog is selected, the outputted value will be the analogical value from the linked channel below. However if Binary is selected, then the outputted value will be condition based for Bit 1 to Bit 15. See below example.	Analog
Sign (Polarity)	The polarity of the outputted value can be INVERTED or set to NORMAL (as is).	Normal
Data type	Specification for numerical data storage. Select: 16-Bit Integer, 32-Bit integer or 32-Bit Floating Point Number	16 Bit Integer
Sign (Integer)	The integer value can be used as a Signed integer or Unsigned integer.	Signed Integer
Multiplication factor	The multiplication factor is used to adapt the acquired value to the configured unit (e.g., there is a factor 1000 between watt and kilowatts). Select: -3.40282×10^{38} to 3.40282×10^{38}	1
Link channel	The analog signal to be sent to the module is configured in this parameter. Type H for help specific to the channel selection.	Not Programmed

If the Link channel type is selection is: 1:Binary, then the triggering source is requested for the Bit 1 to Bit 15. See example below.

Parameters	Description	Default Value
Enter the link channel for Bit 1	The binary condition to be sent to Bit 1 of the corresponding analog output register. Type H for help specific to the channel selection.	Not Programmed
Enter the link channel for Bit 2	The binary condition to be sent to Bit 2 of the corresponding analog output register. Type H for help specific to the channel selection.	Not Programmed
...
Enter the link channel for Bit 15	The binary condition to be sent to Bit 15 of the corresponding analog output register. Type H for help specific to the channel selection.	Not Programmed

Example of a configured generic module's analog output channel (ANALOG TYPE):

FUSION Logout

Multitel

Exit MTQC175-2500: Multitel Demo unit located at 175-2500 Jean-Perrin Street, QC G2C1X1

CRI: 7 MAJ: 2 MIN: 2 INF: 31

Apply Cancel << back

Menu

- Access Control
- Arithmetic
- Audible Alarm
- Battery Reserve
- Battery Runtime
- Binary Manual
- Callout
- Chronometer
- Communication Ports
- Constant
- Daily Statistics Channel List
- Dialup bridge
- Duty Cycle/Average
- EMAIL Protocol
- Front Panel LEDs
- Fusion - I/O Channels
- General System Parameters
- Groups
- I/O Card

Modules

M2R1	Value
Enter channel state (0: Disabled, 1: Enabled or 2: None)	Enabled
Enter channel name (up to 40 chars) ('C' to clear)	Not Programmed
Enter unit (up to 5 chars) ('C' to clear)	Not Programmed
Enter number of decimal digits (0 to 4, 4 = auto)	4
Enter register address (1 - 65535)	1
Enter the reading function code (3: Holding Register 4: Input Register)	3
Enter the writing function code (6: Preset Single Register 16: Write Multiple registers)	6
Enter default output value (-3.40282e+38 - 3.40282e+38)	0
Enter link channel type (0: analog, 1: binary)	analog
Enter sign (0: Normal, 1: Inverted)	Normal
Enter data type 1: 16-Bit Integer 2: 32-Bit Integer 3: 32-Bit Floating Point Number	16-Bit Integer
Enter sign (1: Signed Integer, 2: Unsigned Integer)	Signed Integer
Enter multiplication factor (-3.40282e+38 - 3.40282e+38)	1
Enter the link channel ('H' for help 'C' to clear)	Not Programmed

Example of a configured generic module's analog output channel (BINARY TYPE):

FUSION Logout

Multitel

Exit MTQC175-2500: Multitel Demo unit located at 175-2500 Jean-Perrin Street, QC G2C1X1

CRI: 7 MAJ: 2 MIN: 2 INF: 31

Apply Cancel << back

Menu

- Access Control
- Arithmetic
- Audible Alarm
- Battery Reserve
- Battery Runtime
- Binary Manual
- Callout
- Chronometer
- Communication Ports
- Constant
- Daily Statistics Channel List
- Dialup bridge
- Duty Cycle/Average
- EMAIL Protocol
- Front Panel LEDs
- Fusion - I/O Channels
- General System Parameters
- Groups
- I/O Card
- Lead/Lag
- Links
- Lookup table
- Modbus Display
- Modules
- PID
- Ping
- Programmable Delay
- Programmable Views
- RADIUS Protocol

Modules

M2R1	Value
Enter channel state (0: Disabled, 1: Enabled or 2: None)	Enabled
Enter channel name (up to 40 chars) ('C' to clear)	Not Programmed
Enter unit (up to 5 chars) ('C' to clear)	Not Programmed
Enter number of decimal digits (0 to 4, 4 = auto)	4
Enter register address (1 - 65535)	1
Enter the reading function code (3: Holding Register 4: Input Register)	3
Enter the writing function code (6: Preset Single Register 16: Write Multiple registers)	6
Enter default output value (-3.40282e+38 - 3.40282e+38)	0
Enter link channel type (0: analog, 1: binary)	binary
Enter the link channel for bit 0 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 1 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 2 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 3 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 4 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 5 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 6 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 7 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 8 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 9 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 10 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 11 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 12 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 13 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 14 ('H' for help 'C' to clear)	Not Programmed
Enter the link channel for bit 15 ('H' for help 'C' to clear)	Not Programmed

4.8.6 Generic module's binary output channels configuration

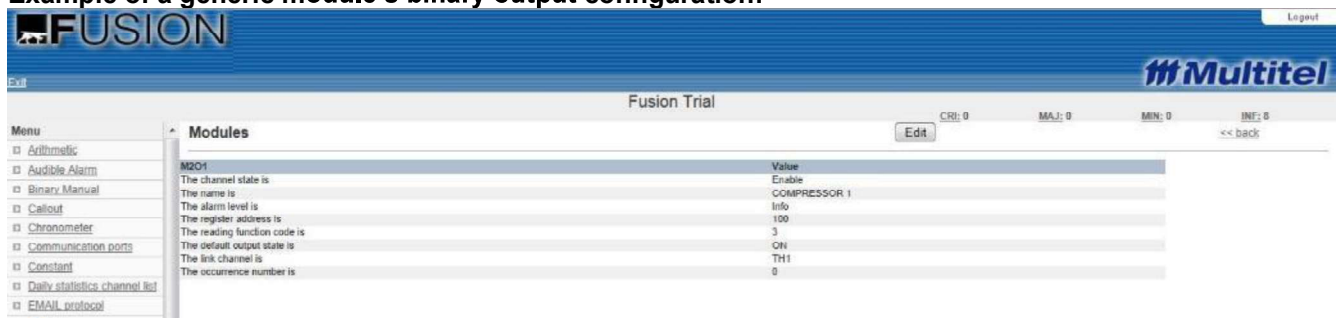
The binary output channels are displayed on the HTTP(S) interface under the **I/O Channels** top menu.

Each module's binary output channel is individually programmable. To configure parameters associated with the **MxOy** mnemonic, click on **Config** from the top menu (Supervisor access only) and then choose **Modules** on the left submenu. Click on the module to be configured. The module must be enabled in order to display the binary input channels available for configuration. Select one of the 8 **MxOy** channels and a list of programmable parameters will be displayed.

Table 15 - MxOy Configuration parameters for a generic module

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each Binary Output Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Not Logged
Register address	In MODBUS modules the coil and discrete input are assigned different address areas. Refer to the MODBUS module instruction manual for more information. Select: 1 to 65 535	1
Reading function code	A single bit physical output is read/write and named a "Coil" and a single bit physical input is read only and named a "Discrete Input". The Bit Holding registers are read/write and Bit Input registers are read only. These 4 types of binary inputs are assigned different address areas in the module. Refer to the device instruction manual for more information. Select: Coil, Discrete Input, Holding Register and Input Register.	Coil
Default output state	Output status used when no link channel is connected. Select: OFF or ON	OFF
Link channel	The binary signal to send to the module is configured in this parameter. Type H for help for the channel selection.	Not Programmed
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	

Example of a generic module's binary output configuration:



4.8.7 SMX module configuration

There are two (2) types of SMX module, the SMX-24AI offers a possibility of associating 24 analog input channels (**MxAy**), the SMX-48BI offers a possibility of 48 binary input channels (**MxEy**).

To configure parameters associated with **M[x]**, click on **Config** from the top menu (Supervisor access only) choose **Modules** on the left submenu and then click on the module **M[x]** to be configured. A list of programmable parameters will be displayed.

Table 16 - Any SMX module configuration parameters M[x]

Parameters	Description	Default Value
Module state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Module identification (Up to 40 characters)	
Slave ID	Slave ID is the identification number of the slave module (Modbus module). Select: between 1 and 255	1
Port	Port Selection to which the module will be connected. Select: RS-485 Back Port or MLINK Port	RS-485 Back Port
Module type	Choose the module type you are configuring. Select: GEN, SMX-48BI or SMX-24AI . To configure the Multitel's Smart Module Expansion for binary inputs acquisition, the selection should be SMX-48BI.	GEN

The SMX communication speed is selected on the module's front panel using one rotary labeled "SPEED", refer to section for that matter. Make certain the FUSION RS-485 or MLINK port and all MODBUS modules daisy chained must be configured with the same communication speed to operate properly.

Example of a SMX-48BI Module configuration:



4.8.8 SMX-48BI's binary input channels configuration

Each module's binary input channel is individually programmable. To configure parameters associated with the MxEy mnemonic, click on **Config** from the top menu (Supervisor access only) and then choose **Modules** on the left submenu. Select the SMX module to be configured. The module has to be enabled in order to proceed with the configuration. Then select one of the 48 **MxEy** channels. A list of programmable parameters will be displayed.

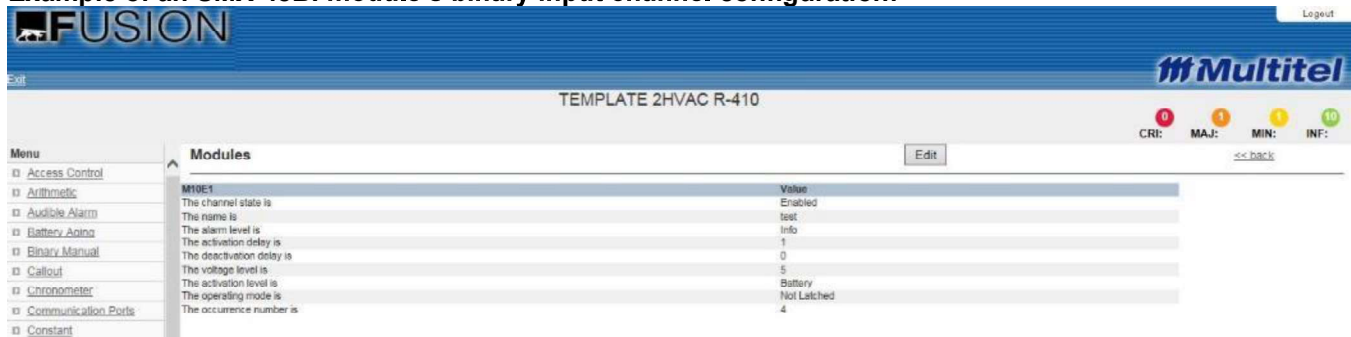
Table 17 - MxEy configuration parameters for a SMX-48BI module

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification (Up to 40 characters)	Not Programmed
Alarm Level	Each Binary Input Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Not Logged
Activation delay	Pre-set time used to delay the input activation, it starts counting on a rising edge of the input. Select: 0 to 999 seconds	0s
Deactivation delay	Pre-set time used to delay the input de-activation, it starts counting on a falling edge of the input. Select: 0 to 999 seconds	0s
Voltage level	Voltage input level. Select: 0 to 70 Volt Absolute (see activation level margin below the table.	5V
Activation level	The activation level enables the user to select between Ground or Battery levels. Refer to the Activation Level margins figure below this table for details.	Ground

Parameters	Description	Default Value
Operating mode	The operating mode enables the user to select between Not latched and latched input channel operation. If the latch option has been selected (once the input is activated) it will remain in this state until a USER with the right permission level enables unlatching of the input.	Not latched
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	

Binary mnemonic **MxEy** can be used as a triggering source to generate automatic callouts, activate front panel LEDs, operate output relays, start a timer, etc.

Example of an SMX-48BI module's binary input channel configuration:



To view the SMX binary input channels statuses on the HTTP(S) interface, go to the **I/O Channels** from the top menu.

To reset latched binary input channels for an SMX-48BI module, go to **System Information** from the top menu, select **Reset** from the left submenu and mouse over the “**Unlatch SMX-48BI card channels**” to confirm the unlatch.

4.8.9 SMX-24AI's analog input channels configuration

SMX Analog input channels are used for different types of measurements. The hybrid front end design enables to easily and efficiently adapt to meet a wide variety of customer needs. Each channel front-end can be selected depending on the following signal type:

- $\pm 65\text{Vdc}$ for CC voltage measurement
- $\pm 50\text{mV}$ for shunt DC current measurement
- Temp for temperature measurement
- 23Vrms for RMS AC voltage measurement
- $\pm 10\text{Vdc}$ for DC voltage measurement
- 1.4Vrms for RMS AC current measurement (compatible to 0-333mV CTs)

To configure channels using the HTTP(S) interface click on **Config** from the top menu (Supervisor access only) and choose **Module** on the left submenu. Click on the desired SMX-24AI module and select **MxAy** channel to be configured. A list of programmable parameters will be displayed.

Table 18- MxAy configuration parameters for a SMX-24AI

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed

Parameters	Description	Default Value
Scale	Scaling factor, Select: 1 to 65 535 (16 bit)	80
Measure unit	Measurement unit, up to 5 characters (e.g. Watt, kWatt). Unit fields are passive enter any required value. Exception: temperature fields as these are active fields. When C or F is entered it is automatically associated with °C or °F. FUSION is in °C by default.	Not Programmed
Number of decimal digits	Analog value representation: Choose between 0 and 4 digits where 4=auto	4
String associated to each code	List the string associated to each code, separated by coma “,”. First string corresponds to code “0” and second string to code “1” and so on.	Not programmed
Front-end	Front-end type: Shunt ($\pm 50\text{mVdc}$), Temp, $\pm 65\text{Vdc}$, 23Vrms , $\pm 10\text{Vdc}$ or 1.4Vrms	Shunt ($\pm 50\text{mVdc}$)
Sign	Polarity: Normal or Inverted	Normal
Offset	The channel offset the by default zero value. The range can be configured between: $(-3.40282\text{e}+38 - 3.40282\text{e}+38)$	0

Example of a configured SMX-24AI analog input channel:

MTQC175-2500: Multitel Demo unit located at 175-2500 Jean-Perrin Street, QC G2C1X1

CR1: MAJ: MIN: INF:

Menu

- Access Control
- Arithmetic
- Audible Alarm
- Binary Manual
- Callout
- Chronometer
- Communication Ports
- Constant
- Daily Statistics Channel List
- Dialup bridge
- Duty Cycle/Average
- EMAIL Protocol
- Front Panel LEDs
- Fusion - I/O Channels
- General System Parameters
- Groups
- I/O Card

Modules

M1A2	Value
Enter channel state (0: Disabled, 1: Enabled or 2: None)	Enabled
Enter channel name (up to 40 chars) ('C' to clear)	Battery Voltage
Enter scale factor (1 to 65535)	65
Enter unit (up to 5 chars) ('C' to clear)	Vdc
Enter number of decimal digits (0 to 4, 4 = auto)	2
Enter strings associated to each code ('C' to clear) Use comma “,” to separate strings, first string links to code 0, second string to code 1, ... - Your entry will only be visible after using the “Apply” button.	Not Programmed
Enter front-end (0:Shunt ($\pm 50\text{mVdc}$), 1:Temp, 2: $\pm 65\text{Vdc}$, 3: 23Vrms , 4: $\pm 10\text{Vdc}$, 5: 1.4Vrms)	$\pm 65\text{Vdc}$
Enter sign (0:Normal, 1:Inverted)	Normal
Enter channel offset $(-3.40282\text{e}+38 - 3.40282\text{e}+38)$	0

To view the SMX analog input channel values on the HTTP(S) interface, go to the **I/O Channels** from the top menu.

Using the SMX modules, Expansion Shelves, ANALOG Cards, MODBUS modules and SNMPget modules the user can expand the FUSION's default capacity from 4, up to more than 1500 analog input channels per installation. Each SMX module is configured as a **M[x]** module in the **Module** submenu. For detail wiring instruction for the SMX-24AI module see section [8.1.10](#).

4.8.10 SMX module specific binary channel configuration

The following binary fail channels have been introduced to report back to FUSION a SMX failure condition. By default, the binary channels are disabled and each channel name are preprogrammed and cannot be edited. To configure these channel, use the **Config** menu and select **Module** in the left sub menu. Click on the desired SMX

module **M(x)** and look down the web page to see these specific binary channels. The specific binary channels for the SMX-48BI and the SMX-24AI are not exactly the same, thus pay attention if you are building a template in a .CSV file to rapidly configure the channels accordingly.

Table 19 – SMX-24AI specific binary fail channels M[x]S[y]

Parameters	Default name	Description
M(x)S1	BOOTLOADER	The SMX firmware does not execute, reboot the SMX module
M(x)S2	NO CONFIGURATION	The SMX module has not received a configuration
M(x)S3	No FEED A	The power provided on FEED A is not within specifications or at fault
M(x)S4	No FEED B	The power provided on FEED B is not within specifications or at fault
M(x)S5	Channel Fault	A analog channel is at fault
M(x)S6	ADC Fault	The Analog to Digital converter has failed
M(x)S7	CARD FAIL	The analog module card is failed

Table 20 - SMX-48BI specific binary fail channels M[x]S[y]

Parameters	Default name	Description
M(x)S1	BOOTLOADER	The SMX firmware does not execute, reboot the SMX module
M(x)S2	NO CONFIGURATION	The SMX module has not received a configuration
M(x)S3	No FEED A	The power provided on FEED A is not within specifications or at fault
M(x)S4	No FEED B	The power provided on FEED B is not within specifications or at fault
M(x)S5	LG Fault	The internal electronic protection on the logic ground is activated. Find the wiring issue and the protection will revert itself.

For all of the above channels, the following operating parameters apply.

Table 21 - Any SMX module specific binary channel parameters M[x]S[y]

Parameters	Description	Default Value
State	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Alarm Level	Each Binary Input Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Not Logged
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	
Channel Name	The name for each SMX specific binary channel is preprogrammed and cannot be modified.	Pre-configured

Example of an SMX specific binary channel configuration:

MTQC175-2500: Multitel Demo unit located at 175-2500 Jean-Perrin Street, QC G2C1X1

Logout

7 1 2 19
CRI: MAJ: MIN: INF:

Apply Cancel << back

Menu

- Access Control
- Arithmetic
- Audible Alarm
- Battery Aging
- Binary Manual
- Callout
- Chronometer
- Communication Ports
- Constant

Modules

M1S3

Field	Value
Enter channel state (0: Disabled, 1: Enabled or 2: None)	Enabled
Enter the alarm level (0: Not Logged, 1: Informational, 2: Minor, 3: Major, 4: Critical)	Minor
Reset occurrence counter (Y/N)	

When specific binary channels are enabled, they will be monitored and made visible in FUSION. For example, FUSION can be configured to trigger a local audible alarm or/and generate an SNMP trap to a final destination to enable advance diagnostics and remediation.

Example of an SMX-24AI module's specific binary channel (see bottom of web page):

MTQC175-2500: Multitel Demo unit located at 175-2500 Jean-Perrin Street, QC G2C1X1

Logout

7 1 2 18
CRI: MAJ: MIN: INF:

Apply << back

Menu

- Access Control
- Arithmetic
- Audible Alarm
- Battery Aging
- Binary Manual
- Callout
- Chronometer
- Communication Ports
- Constant
- Daily Statistics Channel List
- Dialup bridge
- Duty Cycle/Average
- EMAIL Protocol
- Equalize
- Front Panel LEDs
- Fusion - I/O Channels
- General System Parameters
- Groups
- Histogram Statistics
- HVAC
- I/O Card
- Links
- Modbus Display
- Modules
- PID
- Pina

Modules

Mnemonic	Name	State
M1	SMX Analog	Enabled
M1A1	Jar #1 Voltage	Enabled
M1A2	Ambient Temperature	Enabled
M1A3	AC Current	Enabled
M1A4	Indoor Temperature	Enabled
M1A5	Not Programmed	None
M1A6	Not Programmed	None
M1A7	Not Programmed	None
M1A8	Not Programmed	None
M1A9	Not Programmed	None
M1A10	Not Programmed	None
M1A11	Not Programmed	None
M1A12	Not Programmed	None
M1A13	Not Programmed	None
M1A14	Not Programmed	None
M1A15	Not Programmed	None
M1A16	Not Programmed	None
M1A17	Not Programmed	None
M1A18	Not Programmed	None
M1A19	Not Programmed	None
M1A20	Not Programmed	None
M1A21	Not Programmed	None
M1A22	Not Programmed	None
M1A23	Not Programmed	None
M1A24	Not Programmed	None

Mnemonic	Name	State	Occurrence Counter
M1S1	BOOTLOADER	None	0
M1S2	NO CONFIGURATION	Enabled	0
M1S3	No FEED A	None	0
M1S4	No FEED B	None	0
M1S5	Channel Fault	None	0
M1S6	ADC Fault	None	0
M1S7	CARD FAIL	None	0

4.9 SNMPGET MODULES (16)

Instead of using analog channels which are expensive to install, FUSION also has the capability of acquiring binary and analog data from IP supporting devices via SNMP v1 and v2c. E.g. for rectifier energy efficiency calculation FUSION needs load current and voltage. To get these values without installing analog channels FUSION can simply send get requests to any SNMP device at regular time intervals defined by the user.

This section covers how to configure these modules to be able to acquire analog and binary values to FUSION. Once configured the analog or binary channels are processed as any other channels. Thresholds can be set, statistics and history recorded etc. However like MODBUS modules SNMPget module channels do not have the latching option. Refer to section 16 for more information on the SNMP protocol.

The SNMPGet polling frequency is user configurable, the default setting is 1 sec. and can be adjusted between 1 to 65535 seconds. Note that FUSION has the ability to poll all channels simultaneously when the SNMP client device supports multiple OID polling. The SNMPGet polling frequency/delay operating parameter is found in the FUSION's **General System Parameter** Command.

4.9.1 SNMPget modules configuration

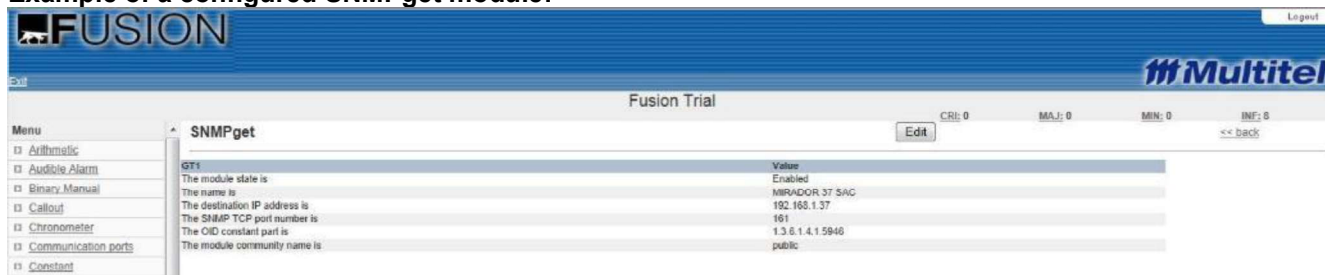
Up to 16 SNMPget modules can be configured in FUSION. For each module, there are 24 analog input channels and 24 binary input channels. To configure parameters associated with the **SNMPget[x]**, click on **Config** from the top menu (Supervisor access only) and then choose **SNMPget** on the left submenu. Click on the module **GT[x]** to be configured. A list of programmable parameters will be displayed. The default polling rate is set to 1 second, the polling delay can be modified in the **"General System Parameters"** HTML page

Table 22 - GT[x] Configuration Parameters

Parameters	Description	Default Value
Module state	Select: Disabled, Enabled or None. When none is selected it will not appear in the configuration file.	None
Name	Module identification. (Up to 40 characters)	
Destination IP address	IP address or domain name of the module used for SNMP protocol. IP address format: NNN.NNN.NNN.NNN	Not Programmed
SNMP TCP port number	The port TCP number is like a channel used to make the connection with remote IP devices. Together with the device IP address it completes the destination address for a communication session.	161
OID constant part	Object Identifiers (OID) are specific codes attached to the information provided by the SNMP device. These OIDs are organized in reference tables called Mibs which are integrated into the device. Multitel provides its Mibs files on the CD coming along with the product. Refer also to APPENDIX B - SNMP INFORMATION for more. Example of an OID constant part: 1.3.6.1.4.1.5946	825700406
Module community name	Name of the group to which hosts running the SNMP service belong. Using a community name provides some security. Like a password an SNMP agent won't respond to a request from a system outside its configured community.	public

A Binary Fail signal **BFGT[x]** will be triggered in case of malfunction of a SNMPget module. In this case, two different statuses for the module or channel can be displayed. The NA status indicates that there is a communication problem or the module is not available. This can happen in the example of a wrong Object Identifier (OID), IP address or domain name, TCP number or community name has been configured or if there is no Ethernet connectivity. The ERR status indicates that the wrong type of data has been received (e.g. an Integer is configured and a string is received). Any of these situations will trigger a BFGT[x] signal.

Example of a configured SNMPget module:



4.9.2 SNMPGet's Analog input channels configuration

The analog input channels are displayed on the HTTP(S) interface under the **I/O Channels** top menu.

Each SNMPget module's analog input channel is individually programmable. To configure parameters associated with the **GTxAy** mnemonic click on **Config** from the top menu (Supervisor access only) and then choose **SNMPget** on the left submenu. Select the module to be configured. The module has to be enabled in order to see the analog input channels available for configuration. Then select one of the 24 **GTxAy** channels. A list of programmable parameters will be displayed.

Table 23 - GTxAy Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Unit	Measurement unit up to 5 characters (ex: Watt, kWatt)	Not Programmed
Number of decimal digits	Selection for the analog value representation: Between 0 and 4 digits where 4=auto	4
Specific part of the OID	The OID constant part is: 1.3.6.1.4.1.5946 and has been already entered in the module configuration. The part the user enters contains a maximum of 25 entries. Refer also to APPENDIX B - SNMP INFORMATION Example of a valid entry: 3.2.1.1.4.4000003	
Data type	Specification for the numerical data storage. Select: Integer or String	Integer
Multiplication factor	A multiplication factor is used to adapt the acquired value to the configured unit (e.g., there is a factor 1000 between watt and kilowatts). Select: -3.40282×10^{38} to 3.40282×10^{38}	1

One or many software thresholds can be associated to each analog channel in order to generate alarms and enable controls. Refer to section [8.3 THRESHOLDS \(1500\)](#).

Example of a configured SNMPget module's analog channel:



4.9.3 SNMPget's Binary input channel configuration

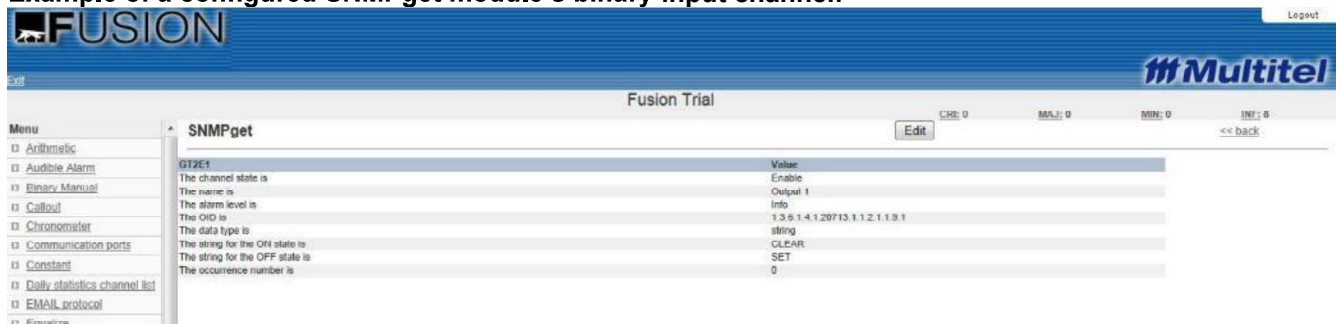
The binary input channels are displayed on the HTTP(S) interface under the **I/O Channels** top menu.

Each SNMPget module's binary input channel is individually programmable. To configure parameters associated with the **GTxAy** mnemonic, click on **Config** from the top menu (Supervisor access only) and then choose **SNMPget** on the left submenu. Select the module to be configured. The module has to be enabled in order to see the binary input channels available for configuration. Then select one of the 24 **GTxEy** channels. A list of programmable parameters will be displayed.

Table 24 - GTxEy Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each Binary Input Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info
Specific part of the OID	The OID constant part is: 1.3.6.1.4.1.5946 and has been already entered in the module configuration. The part the user enters contains a maximum of 25 entries. Refer also to APPENDIX B - SNMP INFORMATION Example of a valid entry: .3.2.2.1.5.3020001	
Data type	Specification of the data storage. Select: Integer or String	Integer
String for the ON state	Character string of maximum length 8 representing the ON status. This parameter is available for configuration only if the Data type String has been selected. Example of a valid entry: CLEAR	Not Programmed
String for the OFF state	Character string of maximum length 8 representing the OFF status. This parameter is available for configuration only if the Data type String has been selected. Example of a valid entry: SET	Not programmed
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	

Example of a configured SNMPget module's binary input channel:



4.10 PING ALARMS (32)

PING is a computer utility used to test device accessibility on an IP network. FUSION can be configured to PING remote or local network elements. FUSION can monitor up to 32 different remote devices or network elements using the PING feature.

The advantage of this feature is to provide a means to reduce overall traffic on the network and maintain optimal network performance by eliminating a remote alarm master generating a PING command over a long distance. These channels are displayed on the HTTP(S) interface under the **Derived channels** top menu.

Each PING function is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Ping** on the left submenu. Then select one of the 32 **PING[x]** channels. A list of programmable parameters will be displayed.

Table 25 - PING[x] Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info
Destination IP address	IP address or domain name of the remote device. IP address format: NNN.NNN.NNN.NNN	Not Programmed
Delay between PING	Delays between PINGs sent by the master to the remote device. When a device fails to response accordingly, the corresponding PING mnemonic will turn "ON", indicating a PING alarm has been triggered. To trigger the alarm condition the failure to respond to a PING must be repeated for at least 3 consecutive tries. Select: 1, 5, 30 or 60 seconds	5 s
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	0

The **PING[x]** mnemonic can also be used as a triggering source to generate automatic callouts, activate front panel LEDs, operate output relays, start a timer, etc.

4.11 FRONT PANEL'S LED (OPTION)

Alarms can be programmed to turn on a specific front panel LED (LED1 to LED16). Each LED can display 3 different colours to represent alarm severity levels. These channels are displayed on the HTTP(S) interface under the **Derived channels** top menu.

Each **LED[x]** function is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Front panel LEDs** on the left submenu. Then select one of the 16 **LED[x]** channels. A list of programmable parameters will be displayed.

Table 26 - LED[x] Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Triggering source: INformation	Triggering source from Informational alarm level used to activate the LED. Yellow	
Triggering source: MINor	Triggering source from minor alarm level used to activate the LED. Yellow	
Triggering source: MAJor	Triggering source from major alarm level used to activate the LED. Steady Red	

Parameters	Description	Default Value
Triggering source: CRITICAL	Triggering source from critical alarm level used to activate the LED. Flashing Red	
Alarm Level	Each Binary Input Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	0

The LED colour is defined by the alarm type and status of the triggering source. If more than two (2) alarm types are triggered for a single LED, the most severe will be displayed.

Table 27 - LED front panel colour meaning

LED Colour	Description
OFF	Not in service, not programmed or in service but without any triggering source available (NA)
Green	In service, without any active alarm triggering source
Yellow	In service, with an active triggering source for a minor or informational alarm
Red	In service, with an active triggering source for a major alarm
Flashes RED/OFF	In service, with an active triggering source for a critical alarm

4.12 AUDIBLE ALARMS (OPTION)

The **AUDIBLE alarm** function is used to program a list of alarms that will trigger the audible alarm located on the FUSION's front panel. Up to 500 triggering sources can be programmed.

Click on **Config** from the top menu (Supervisor access only) and then choose **AUDIBLE Alarm** on the left submenu. The audible alarm function is then ready to be configured.

Table 28 - Audible Alarm Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled or Enabled.	Disabled
Triggering sources	It is possible to configure up to 500 triggering sources to trigger the Audible alarm.	

All possible triggering sources are listed in Table 31 and Table 32.

This function also generates the following triggering sources:

Table 29 - Audible monitoring triggering sources

Sources	Definition
AUDMIN	Monitors all minor sources programmed in AUDIBLE and extends a "true" condition if one of these sources is "true" and no A.C.O. (Audible Cut Off) was pressed.
VISMIN	Monitors all minor sources programmed in AUDIBLE and extends a "true" condition if one of these sources is "true".
AUDMAJ	Monitors all major terms programmed in AUDIBLE and extends a "true" condition if one of these sources is "true" and no A.C.O. was pressed.
VISMAJ	Monitors all major sources programmed in AUDIBLE and extends a "true" condition if one of these sources is "true".

Sources	Definition
ALARM	Signal activated as soon as one of the triggering source programmed in AUDIBLE is "true".

4.13 TRIGGERING SOURCES

A source indicates a function's logical status. It becomes a trigger when it is used as a triggering source or in the form of a Logical equation. For each of the triggering source, the following logical statuses are possible:

Table 30 - Triggering source possible logical status

Status	Description
OFF	The source is inactive. (F1O1 = OFF; indicates that output #1 on FUSION is inactive.)
NA	The source is Not Available (this may happen if a card failed and values cannot be read).
ON	The source is active. (F1E13 = ON; indicates that event #13 on FUSION is active.)
DIS	The source is not configured or disabled.
ERR	This status is available only for MODBUS, SNMPget modules and PID functions. It means wrong configuration parameters for MODBUS modules and PID functions. For SNMPget modules, it means that a wrong data type has been received.

The following table presents the list of all available triggering sources which may be used to generate automatic callouts, activate front panel LEDs, operate output relays, start a timer, etc. Triggering sources can be negated when used as a parameter.

4.13.1 List of possible triggering sources

Table 31 - List of all possible triggering sources

Mnemonic	Description	Indication
FxEy	User programmable	Event status, FUSION EXP card, channel y.
FxOy	User programmable	Output status, FUSION EXP card, channel y.
CxEy	User programmable	Event status, card x, channel y.
CxOy	User programmable	Output status, card x, channel y.
BM[x]	User programmable	Binary Manual x status.
G[x]	User programmable	Group x status.
TH[x]	User programmable	Threshold x status.
COU[x]	Callout	Automatic callout x status.
TSP[x]	User programmable	Programmable timer x status.
LED[x]	User programmable	Front panel LED indicator x status.
LKU[x]	User programmable	Lookup Table x status.
DEL[x]	User programmable	Programmable delay x status.
PING[x]	Ethernet device accessibility	Failure to reach the configured Ethernet device
MxEy	User programmable	Event status, module x, channel y.
MxOy	User programmable	Output status, module x, channel y.
AUDMIN	Audible minor alarm	Audible Minor alarm status.
AUDMAJ	Audible major alarm	Audible Major alarm status.
VISMIN	Visual minor alarm	Visual Minor alarm status.
VISMAJ	Visual major alarm	Visual Major alarm status.
ACO	Audible alarm cancellation	"Audible cut off" status.
ALARM	Major Alarm	Audible Major alarm status.
INFO	Information	At least one Informational alarm.
MIN	Minor	At least one Minor alarm.

Mnemonic	Description	Indication
MAJ	Major	At least one Major alarm.
CRI	Critical	At least one Critical alarm.
INTRU	Intrusion	Intrusion attempt (Informational alarm level).
USER[x]	User programmable	Status of a user (Informational alarm level).
SUSER[x]	Super user	Status of a super user (Informational alarm level).
GTxEy	User programmable	Event status, SNMPget module x, channel y.
SCH[x]	User programmable	Status of a schedule channel.
ACC[x]	User programmable	Status of an Access channel.
ACTL[x]	User programmable	Status of an access control channel.
ON	Permanently active signal	Logical 1.
AIN[x]	FUSION intrusion alarm (HID card reader)	An HID card without authorized access has been presented to one HID card reader (x=1 to 4).

4.13.2 List of binary fail signals (BF)

Binary Fail (**BF**) channels are FUSION internal failure alarms. The following BF channels may also be used as triggering sources. These alarm levels are Informational.

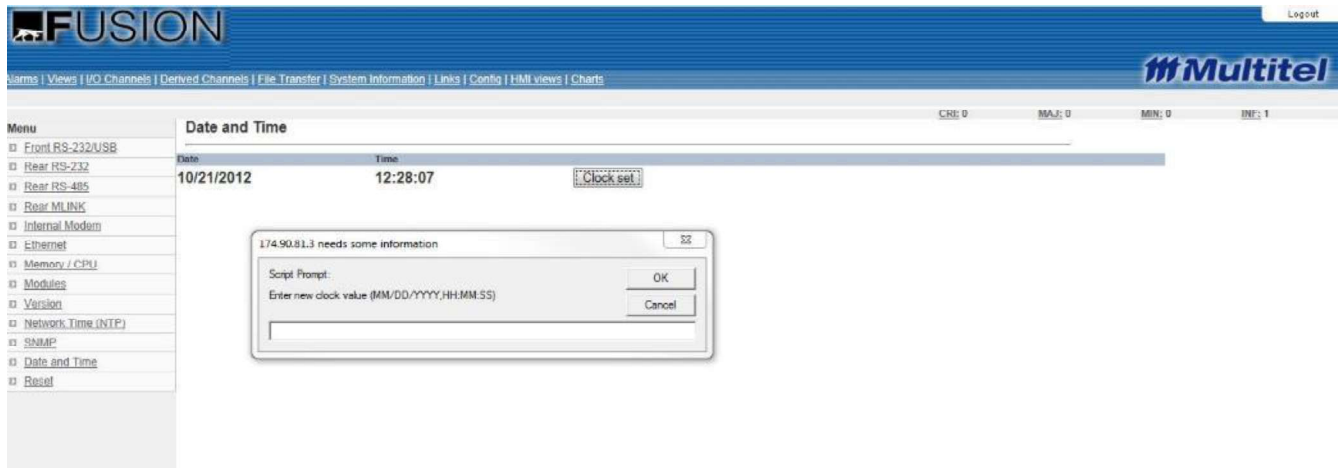
Table 32 - List of all Binary Fail (BF)

Status	Description
BFSYS	Indicates that one of the following BF channels is ON (except for date/time change)
BFCPUR	ON/OFF transition when system powers up.
BFDTC	ON/OFF transition when date/time is changed.
BFPHY	Indicates a problem with physical layer of Ethernet.
BFRTC	Indicates a problem with on-board real time clock.
BFEED	Indicates a problem with EEPROM memory.
BFFEED	Indicates a problem with one of the two (2) power feeds. – See General System Parameter to disable alarm
BFFLASH	Indicates a problem with FLASH memory.
BFMOD	Indicates a problem initiating a modem.
BFFP	Indicates a problem communicating with the front panel.
BFCFG	Indicates a fatal error in configuration.
BFC[x]	Indicates a problem communicating with one of the Expansion shelf's acquisition cards.
BFM[x]	Indicates a problem communicating with one of the MODBUS Module or a configuration problem.
BFNTP	Indicates that NTP server is not available.
BFF1	Indicates a problem communicating with one of FUSION I/O card.
BFGT[x]	Indicates a problem communicating with the SNMPget[x] module or a configuration problem.
BFPID[x]	Indicates a problem with the PID[x] parameterisation.
BFACTL[x]	Indicates a problem communicating with the HID card reader system (access control)
BFDISP	Indicates that the MODBUS Display (RMD) is not available.

4.14 SETTING DATE AND TIME

Users can change the Date and Time of their FUSION. Click on **System Information** from the top menu and then click on **Date and Time** on the left submenu. Select the **Clock set** button and a window will appear asking to

enter new date and time in the pre-defined format. Following is a view of what is shown when the Clock set button is selected.



4.15 PERFORMING VARIOUS RESETS

Some FUSION functions or parameters may need to be reset or initialized during operation. The Reset Functions are located in the **System Information** from the top menu under **Reset** on the left submenu. **RESET** operations are available from the **USER** and **VIEWER** access levels and initialisation functions can be performed on the FUSION HTTP(S) interface. Few of them are only accessible via the Command Line Interface. Refer to section 5.2 for information on the Command Line Interface.

SUPERVISOR access level is able to RESET or initialise the following files or parameters:

1. Operating parameters
2. Statistics and History files
 - Erase Statistics for one channel
 - Erase Daily Statistics for all channels
 - Triggered Statistics and Triggered Statistics (protected)
 - Erase Peak Statistics for one channel
 - History log file
 - All files
3. All occurrences counter
4. System reboot
5. Energy counter (Expansion Shelf I/O cards)
6. Unlatch SMX-48BI channels, FUSION channels, EVENT card channels or Groups (Some may not display if no channels are available to unlatch)
7. Chronometer and Watthour initialisation
8. View and Reset an occurrence counter (Command Line Interface only)

USER access level has is able to RESET or initialise the following files or parameters:

1. All occurrences counters
2. Energy counter
3. Unlatch EVENT card alarms or group (if it was allowed when the USER has been configured)
4. Chronometer and Watthour initialisation
5. View and Reset an occurrence counter

VIEWER access level has two reset choices:

1. Unlatch EVENT card alarms or group (if it was enabled when the USER was configured)
2. View and Reset an occurrence counter



IMPORTANT:

Reset functions can seriously disturb the system's operation. Therefore, the RESET functions should be handled with caution.

Following is a view of what is shown when the RESET submenu is selected on the HTTP(S) interface. To perform a reset, mouse over the desired underlined statement and confirm action by clicking on the statement. IF the statement is not underlined, it means there are no motivation for a reset.

The screenshot shows the FUSION web interface. At the top, there's a navigation bar with 'FUSION' and 'Multitel' logos. Below it, a status bar displays 'MTQC175-2500: Multitel Demo unit located at 175-2500 Jean-Perrin Street, QC G2C1X1'. On the right, there are status indicators for CRI, MAJ, MIN, and INF. The main content area is divided into a 'Menu' sidebar and a 'Reset' submenu. The 'Reset' submenu lists various options, some of which are underlined, indicating they can be reset. These include 'Operating Parameters', 'Statistics and History files', 'Erase Daily Statistics for one channel', 'Erase Daily Statistics for all channels', 'Triggered Statistics and Triggered Statistics (Protected)', 'Erase Peak Statistics for one channel', 'Erase Peak Statistics for all channels', 'History log file', 'Histogram Statistics', 'All files', 'All Occurrences counter', 'System Reboot', 'Energy counter', 'Reset communication statistics for one module', 'Reset communication statistics for all modules', 'Unlatch SMX-48BI card channels', 'Event fusion (FxEx)', 'Event cards (CxEx)', and 'Group (Gx)'.

4.15.1 Reset operating parameters

Communication ports configuration will not be erased when operating parameters are reset. All other parameters will be reset to default values. The system will reboot. This is used for training or demo units to return FUSION to its initial factory configured state.

4.15.2 Reset statistics and history files

The User can choose from these options:

- Erase Statistics for one channel
- Erase Daily Statistics for all channels
- Triggered Statistics and Triggered Statistics (protected)
- Erase Peak Statistics for one channel
- History log file
- All files

4.15.3 Reset all occurrences counters

This option is used to reset all occurrences counters at once. Confirmation is required and the option to cancel is also available.

4.15.4 Performing a reboot

The System Reboot has the same effect as a power failure. If this option is selected a warning is displayed that Triggered Statistics files will be erased. Confirmation is required to reboot the system. If Cancel is chosen FUSION returns to the Reset submenu and the reboot is not activated. If OK is chosen FUSION will reboot and after a few minutes FUSION's home page reappears.

4.15.5 Reset energy counter

A virtual channel can be configured as an energy counter channel (current integration with time) using the Expansion Shelf's I/O cards. The channel cannot be configured with a triggering source, as it is simply a counter. To reset the Energy counter click on the card under the **Reset** submenu and select **Energy Counter**. No card will appear under the Energy Counter option if no Expansion Shelf card is configured. For a more thorough explanation of this feature, please refer to the Expansion Shelf user manual.

4.15.6 Reset communication statistics for one module

This option is used to reset the MODBUS communication error rate statistics and start with new data. It is a good idea to perform a reset when commissioning new module.

4.15.7 Unlatch SMX module, event fusion (FxEx), event card (CxEx) or group (Gx)

This option is now available through the HTTP(S) interface and Command line Interface. (Command Line Interface Refer to section 5.2) FUSION can use an I/O channel to latch an alarm and it will remain latched until a manual reset is performed by the user. This option is not available for MODBUS Module and SNMPget Modules event channels. The group function G[x] can also be latched. Depending on the user's access level, the user can perform some Reset. To unlatch SMX-48BI channels, Event card alarms or groups select item #3 and the following options will be displayed:

Unlatch

1. Unlatch SMX-48BI card channels (MxEy)
2. Event Fusion (FxEx)
2. Event cards (CxEx)
3. Group (Gx)

The user can unlatch the Event SMX-48BI (MxEy), Event FUSION (FxEx), Event Cards (CxEx) or Groups (Gx). Whichever option is selected will unlatch **all** MxEy, FxEx, CxEx or G[x] mnemonics.

The users with USER and VIEWER access levels must have permissions configured in their user profiles to access this feature. If the unlatch is attempted without permission, the following is displayed: **The user does not have the right to this action.**

4.15.8 Initialisation of chronometer and watthour

A chronometer channel enables the user to time certain events. (E.g. generator usage) The timer will count in seconds, minutes or hours. In cumulative mode, the timer will continue counting every time the triggering source is ON. Using the reset function when the Chronometer channels **ACHR[x]** are in cumulative mode the user can initialise the channel with an offset value or a zero value. As an example, the Watthour channels **AWH[x]** can be used to monitor the battery discharge in cumulative mode.

NOTE : In firmware version 4.80 and above, a new triggering source operating parameter must be configured for each ACH channel to automatically perform a reset of the counter.

This option is only available through the Command line Interface. (Command Line Interface, refer to section 5.2) The Reset command will display a list of resettable file parameters depending on the access level of the user. To initialise Chronometer or Watthour select item #4 from the Reset menu and select from the following:

1. ACHRx Reset Chronometer channels. (see note above)
2. AWHx Initiate Watt Hour (DC) channels.

When the user selects the initialisation option the user will be asked to enter an initialisation value for the selected channel (where Enter equals Zero) for both channel types. The user can also enter an offset value as required.

4.15.9 View or reset an occurrence counter

FUSION provides an occurrence counter for all software functions whenever possible. The occurrence counter is used to count the number of times a binary condition is activated (e.g. binary input channel activation, a relay output operation, threshold activation, a programmable delay triggered). An occurrence counter used in conjunction with thresholds can be used to cycle the operation of specific equipment and/or count a cycling sequence as follows:

- Trigger generator group #2 after 3 cycles of generator group #1
- Count the number of battery discharges
- Count the number of times a door is opened

Use the **TH[x]** function to program an occurrence counter with a specific trigger.

This option is only available through the Command line Interface. (Refer to section 5.2) The Reset command will display a list of resettable file parameters depending on the access level of the user. To view or reset an occurrence counter select item #5 from the reset counter.

Select the required triggering source from the menu and the occurrence counter number of the selected source will be displayed and the user is asked if the occurrence number should be reset. (Type "H" to get a list of all triggering sources)

The occurrence counter can also be individually reset using the corresponding mnemonic configuration. For example when configuring USER1 the user will be asked if the occurrence counter should be reset.

5 USER INTERFACES

5.1 HTTP(S) INTERFACE (HTTP PROTOCOL)

Most features of FUSION can be accessed through convenient HTTP(S) interface. To access the HTTP(S) interface for the first time, use the FUSION system default IP address (192.168.1.1) and logon as SUPERVISOR and no password. The user can then configure a **USER** to access FUSION and change the IP address.

5.1.1 HTTP(S) interface overview

The HTTP(S) interface enables users to view unit alarms, programmed views, I/O channel values and statuses, derived channel values in real time. The HTTP(S) interface also has system information, Multitel's programmed links, HMI views and chart functions for improved visuals for a global understanding of the plant processes. It also enables the user to download files such as statistics and history and to upload configuration settings. Most of the operating parameters can be edited using the HTTP(S) interface.

5.1.2 HTTPS Performance

Multitel recommends the use of Firefox browser to communicate in the secure http mode as other browsers make the communication unusable. Firefox lets you fix the TLS version supported and allows you to adjust the number of http persistent connection to increase performance with the FUSION web server. Please refer to section 1.4 HTTPS Performance.

5.1.3 Login into the HTTP(S) interface

To login into FUSION's HTTP(S) interface, type the user name and password. Access rights are the same as for any other FUSION interface.



The screenshot shows the login page for the FUSION Energy Management DEMO. At the top, there is a blue header bar with the 'FUSION' logo on the left and the 'Multitel' logo on the right. Below the header, the text 'Energy Management DEMO' is centered. A prompt 'Enter your user name and your password.' is displayed. Below this, there are two input fields: 'User Name:' and 'Password:'. A 'Login' button is positioned below the password field. At the bottom of the page, a timestamp '05/19/2012 10:53:01.517' is visible.

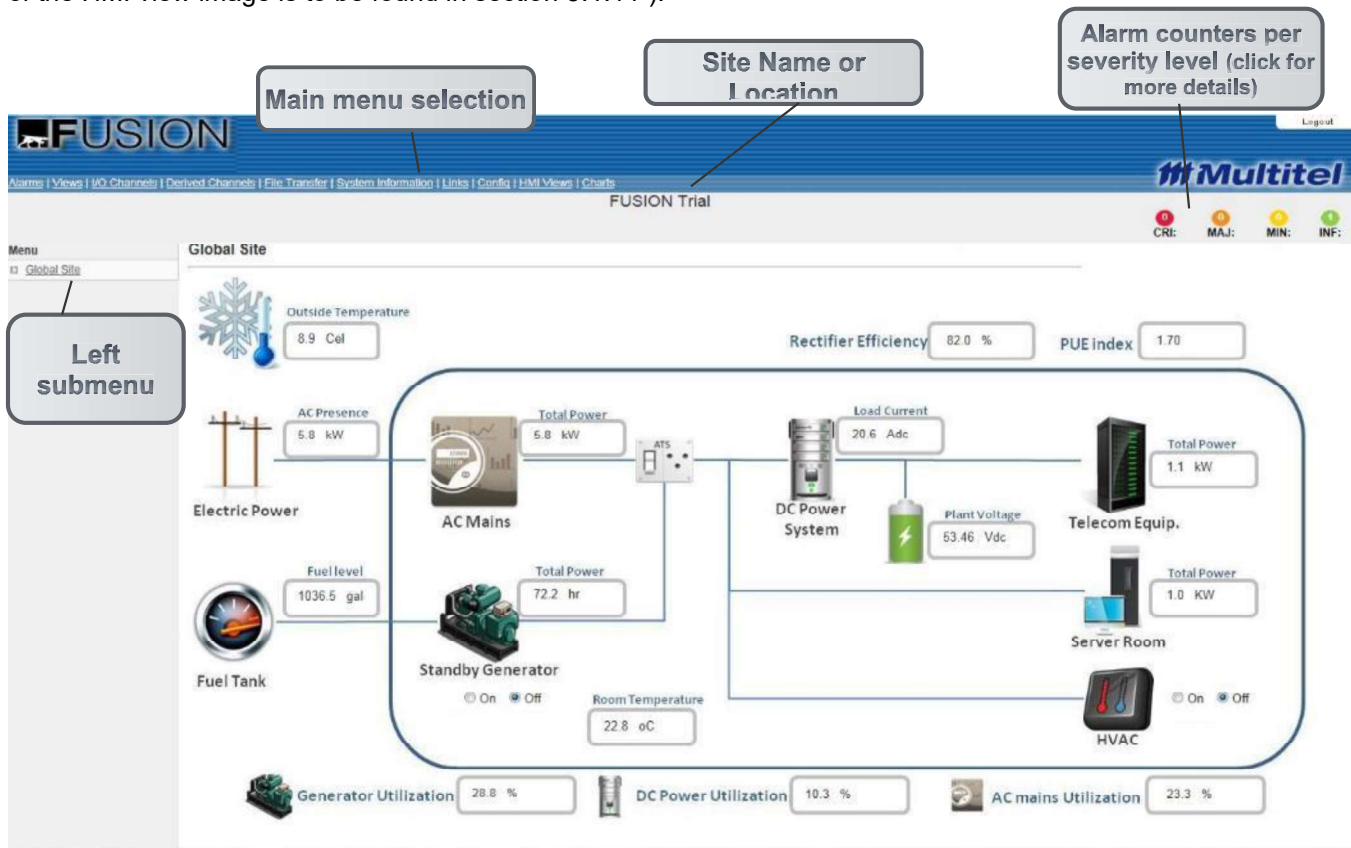
For network security reasons, if an invalid username or password is entered when trying to login, the following message will be displayed: Unable to login. Invalid user name or password. After three unsuccessful login attempts, the following message will be displayed: Unable to login. Invalid user name or password. Intrusion attempts logged. Please try again later.

NB: After an Intrusion Attempt, a User will have to initiate a new HTTP(S) session before trying another login from the same source IP address. FUSION will continue for a period of 15 minutes to prevent Intrusions.

The HTTP(S) page refresh rate can be configured with the **General System Parameters (Config menu)**. The rate is configurable between 0 and 999 seconds where 0 is equivalent to disabling the function. It is important to note that the refresh cycle of some browsers reposition the view to the top of the page when the view is bigger than the screen.

If the Human Machine Interface (HMI) view is already loaded into FUSION the home page will show the selected view. Otherwise the **Alarms** menu will be displayed as the home page. HMI view selection is done in the **General system parameters** configuration (section 4.3).

Following is an overview of the home page on FUSION's HTTP(S) interface, with HMI view enabled (Description of the HMI view image is to be found in section 5.1.11):



FUSION's HTTP(S) interface, showing the **I/O channels** page:

The screenshot displays the FUSION web interface. The top navigation bar includes links for 'Alarms', 'Views', 'I/O Channels', 'Derived Channels', 'File Transfer', 'System Information', 'Links', 'Config', 'HMI Views', and 'Charts'. The 'FUSION Trial' watermark is visible. The left menu shows 'Fusion - I/O Channels' selected. The main content area is titled 'Fusion - I/O Channels' and contains three tables of data. The first table shows analog channels (F1A1 to F1A11) with values like 0.96 VDC, 40.8 %, and 61.38. The second table shows binary channels (F1E1 to F1E3) with values ON/OFF and occurrence counters. The third table shows binary output statuses (F1O1 to F1O3) with values ON/OFF and occurrence counters. Callouts highlight specific features: 'Selected submenu title' points to the 'Fusion - I/O Channels' title; 'To end the session' points to the 'Logout' link; 'Upper field showing Analog' points to the first table; 'Submenu based on main menu selection' points to the 'Fusion - I/O Channels' menu item; 'Middle field showing Binary' points to the second table; and 'Lower field showing Binary Output statuses' points to the third table.

5.1.4 Menus description

Table 33 - Menus description for HTTP(S) interface

Main Menu	Submenu	Description
Alarms	All Active Alarms	Displays all currently active alarms in a chronological order.
	Critical	Displays only the Critical alarms in a chronological order.
	Major	Displays only the Major alarms in a chronological order.
	Minor	Displays only the Minor alarms in a chronological order.
Views	Informational	Displays only the Informational alarms in a chronological order.
	View(x) - up to 32 programmed views	Displays list of any type of channels (I/O or derived) in the way they were configured.
I/O Channels	Fusion - I/O Channels	Displays enabled channels consecutively for each EXP I/O board configured.
	Cards	Displays enabled channels consecutively for each Expansion shelf I/O card configured.
	Module(x) - up to 64 modules	Displays enabled channels consecutively for each MODBUS module configured.
	SNMPget(x) - up to 16 modules	Displays enabled channels consecutively for each SNMP device configured.

Main Menu	Submenu	Description
Derived channels	Arithmetic – up to 220 channels	Displays enabled channels consecutively for each AAR[x] function configured.
	Access	Function related to the use of an HID card reader developed by Multitel. Displays enabled ACC[x] channels.
	Access control	Function related to the use of an HID card reader developed by Multitel. Displays enabled Access channels consecutively for each ACTL[x] channels configured.
	Battery Aging	Displays the BAG channel with its value in hours.
	Binary Manual – up to 128 channels	Displays enabled channels consecutively for each BM[x] function configured.
	Callout – up to 32 channels	Displays enabled channels consecutively for each CALLOUT[x] function configured.
	Chronometer – up to 10 channels	Displays enabled channels consecutively for each ACHR[x] function configured.
	Constant - up to 32 channels	Displays enabled channels consecutively for each CONST[x] function configured.
	Dialup Bridge – Up to 8 channels	Displays enabled channels consecutively for each DB[x] function configured.
	Duty Cycle/average – up to 10 channels	Displays enabled channels consecutively for each DCC[x] functions configured.
	Front panel LEDs – up to 16 channels	Displays each LED[x] function associated to the LEDs on the front panel.
	Groups – up to 200 channels	Displays enabled channels consecutively for each G[x] function configured.
	Lookup Table – 4 channels	Displays enabled channels consecutively for each LKU[x] function configured.
	PID – up to 8 channels	Displays enabled channels consecutively for each PID[x] function configured.
	Ping – up to 32 channels	Displays enabled channels consecutively for each PING[x] alarm function configured.
	Programmable Delay – up to 128 channels	Displays enabled channels consecutively for each DELAY[x] function configured.
	Programmable Delay Value – up to 128 channels	Displays the associated programmable delay duration remaining time in seconds.
	Schedule	Function related to the use of an HID card reader developed by Multitel. Description of this specific system is documented in section 9.2.4 . Displays enabled SCH[x] channels.
	Thresholds – up to 1500 channels	Displays enabled channels consecutively for each TH[x] function configured.
	Time Set Point - up to 64 channels	Displays enabled channels consecutively for each TSP[x] function configured.
	User – up to 10 channels	Displays enabled channels consecutively for each USER[x] function configured.
	Watthour – up to 10 channels	Displays enabled channels consecutively for each AWH[x] function configured.
File Transfer	Download	Enables the user to download the following files: Configuration, ACC Configuration, History log, System Log, Triggered statistics, Triggered statistics protected file, Peak statistics, Daily statistics, images and Note.

Main Menu	Submenu	Description
System Information	Upload	Enables the user to upload the configuration file, code, card code, image files (.XMG), SSH RSA Private Key, Note File, SSL Private Key and SSL Certificate.
	File management	Enables the user to manage files.
	Front RS-232/USB	Enables the user to view the port configuration.
	Rear RS-232	Enables the user to view the port configuration.
	Rear RS-485	Enables the user to view the port configuration.
	Rear MLINK	Enables the user to view the port configuration.
	Internal Modem	Enables the user to view the modem configuration if installed.
	Ethernet	Enables the user to view the port configuration.
	Memory/CPU	Enables the user to view FUSION's remaining memory capacity, processor total utilization percentage and also FUSION's CPU derived channel processing.
	Modules	Enables the user to view each MODBUS module configuration and status.
	Version	Enables the user to poll the software and hardware release numbers and statuses for each FUSION's hardware component.
	Network Time (NTP)	Enables the user to view the NTP configuration.
	SNMP	Enables the user to view the SNMP protocol configuration.
	Date and Time	Enables the user to view and change the FUSION Date and Time.
	Reset	Enables the user to perform various function or parameter reset.
	NOTE file	Enables the user to view the NOTE file.
	Event Analog Value	Enables user to view the voltage presence for each FUSION's binary input channels. Very useful for troubleshooting.
Links	User defined links	Links configured in FUSION.
Config Supervisor access level	Access control	Enables the user to configure parameters related to all the specific functions, I/O channels, modules, protocols, communication ports... Each configuration item on the left submenu is described with a parameter table in this manual.
	Arithmetic	
	Audible Alarm	
	Battery Aging	
	Binary manual	
	Callout	
	Chronometer	
	Communication Ports	
	Constant	
	Daily statistics channel list	
	Dialup Bridge	
	Duty Cycle/Average	
	EMAIL protocol	
	Front panel LEDs	
	Fusion – I/O Channels	
	General System Parameters	
	Groups	
	Lookup Table	
	I/O Card	
	Links	
	Module Display	

Main Menu	Submenu	Description
	Modules	
	PID	
	Ping	
	Programmable Delay	
	Programmable views	
	Radius protocol	
	Schedule	
	SNMP protocol	
	SNMP get	
	SYSLOG protocol	
	Telnet/SSH TCP Port	
	Thresholds	
	Time Set Point	
	Triggered Statistics	
	Triggered Statistics (protected)	
	User	
	Wattour	
	User defined HMI views	
HMI views		An HMI Image is a graphical view of alarm status and measured values which represent a specific or general site application. These can be loaded to FUSION with the file transfer function (see section HMI view).
Charts	User defined Triggered Statistics files for performing trending studies	Function used to display online graphs of configured Triggered Statistics.

5.1.5 Alarms, Views, I/O channels and Derived channels

These top menu items enable the **USER** to visualize: **alarms**, programmed **views**, **I/O channels** and **derived channels** information in real time. Following are some illustrations of these FUSION's HTTP(S) interface pages.

First, the **Alarms** page (FUSION's home page when no HMI is loaded):

The screenshot shows the FUSION interface with the 'Alarms' menu selected. The page displays a table titled 'ALL ACTIVE ALARMS' with columns for Mnemonic, Channel Name, Severity, and Occurrence Counter. The table lists several alarms, including 'mutille', 'SYSTEM FAULT', 'ERR. Modbus Module 1', 'ERR. Modbus Module 2', 'ERR. GET SNMP channel 2', and 'ERR. PID channel 1'. To the right of the table, there are four circular indicators for severity levels: CRITICAL (0), MAJOR (0), MINOR (0), and INFO (1). A callout box points to the 'All Active Alarms' menu item, stating: 'Choose to see all alarms or specify the alarm level for the alarms to be displayed'. Another callout box points to the severity indicators, stating: 'Alarm counters per severity level are always displayed on the HTTP(S) interface'.

The **Views** page

The screenshot shows the FUSION interface with the 'Views' menu selected. The page displays a table titled 'FUSION' with columns for Mnemonic, Channel Name, Severity, and Occurrence Counter. The table lists several views, including 'mutille', 'SYSTEM FAULT', 'ERR. Modbus Module 1', 'ERR. Modbus Module 2', 'ERR. GET SNMP channel 2', and 'ERR. PID channel 1'. To the right of the table, there are four circular indicators for severity levels: CRITICAL (0), MAJOR (0), MINOR (0), and INFO (1). A callout box points to the 'Views' menu item, stating: 'Anywhere on the HTTP(S) interface, when a binary channel is selected the history statistics for the mnemonic are displayed'.

The screenshot shows the 'Fusion Trial' interface with the 'I/O Channels' menu selected. The 'View 3 - HVAC Control' section displays two tables. The first table shows binary data for COMPRESSOR 1 and COOLING TEMP 23°C. The second table shows analog data for Room Temperature and COMPRESSOR OFF TEMP.

Mnemonic	Channel Name	Value	Occurrence Counter
M201	COMPRESSOR 1	OFF	9
TH1	COOLING TEMP 23°C	OFF	0

Mnemonic	Channel Name	Value
MTA1	Room Temperature	25.60 °C
COH012	COMPRESSOR OFF TEMP	26.99 °C

The I/O channels page:

The upper section displays the binary values and the lower section displays the analog values.

The screenshot shows the 'Fusion - I/O Channels' page. The left sidebar lists various channels, including Plant voltage, Ambient Humidity, and various temperature and humidity channels. The main table displays the values for these channels.

Mnemonic	Channel Name	Value	Occurrence Counter
F1A1	Plant voltage	0.56 VDC	
F1A5	Ambient Humidity	40.8 %	
F1A6	Not Programmed	61.38	
F1A7	Not Programmed	61.38	
F1A8	Not Programmed	61.38	
F1A9	Not Programmed	61.38	
F1A10	Ambient Temperature	61.38	
F1A11	Not Programmed	61.38	
F1E1	DOOR OPEN	ON	1
F1E2	BATTERY ON DISCHARGE	OFF	0
F1E3	GENERATOR RUNNING	OFF	0
F1G1	DOOR OPEN	ON	1
F1G2	BATTERY ON DISCHARGE	OFF	0
F1G3	GENERATOR RUNNING	OFF	0

The left submenu displays one Fusion I/O cards, 2 Modbus modules and 3...

Anywhere on the HTTP(S) interface, when an analog or virtual channel is selected the daily statistics for the mnemonic are displayed

The **Derived Channels** page (derived channels are FUSION's internal user configured channels):

The screenshot shows the 'Callout' page with a list of 32 derived channels. The left sidebar lists various channels, including Callout, Chronometer, Constant, Duty Cycle/Average, Equalize, Front Panel LEDs, Groups, PID, Ping, Programmable Delay, Rectifier, Schedule, Thresholds, Time Set Points, User, and Watchdog.

Mnemonic	Channel Name	Value	Occurrence Counter
COU11	FIRM Suite	OFF	0
COU12	Not Programmed	OFF	0
COU13	Not Programmed	OFF	0
COU14	Not Programmed	OFF	0
COU15	Not Programmed	OFF	0
COU16	Not Programmed	OFF	0
COU17	Not Programmed	OFF	0
COU18	Not Programmed	OFF	0
COU19	Not Programmed	OFF	0
COU20	Not Programmed	OFF	0
COU21	Not Programmed	OFF	0
COU22	Not Programmed	OFF	0
COU23	Not Programmed	OFF	0
COU24	Not Programmed	OFF	0
COU25	Not Programmed	OFF	0
COU26	Not Programmed	OFF	0
COU27	Not Programmed	OFF	0
COU28	Not Programmed	OFF	0
COU29	Not Programmed	OFF	0
COU30	Not Programmed	OFF	0
COU31	Not Programmed	OFF	0
COU32	Not Programmed	OFF	0

The 32 available Callout channels are displayed, even if not programmed

All available derived channels

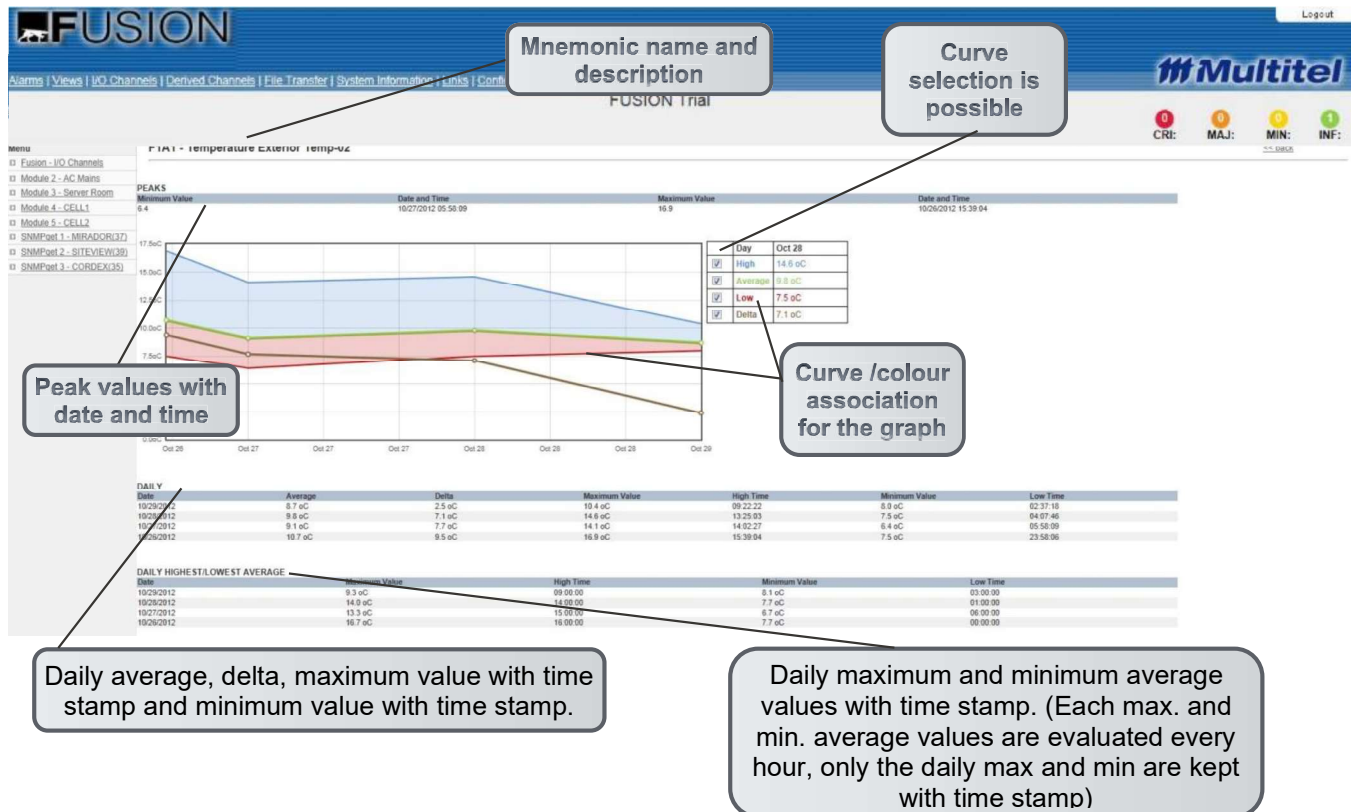
5.1.6 Graphic and daily statistics for mnemonics representing analog values

For each mnemonic representing an analog value (I/O channels and derived channels), clicking on the mnemonic displays:

- Peak values, minimum and maximum values with time stamp
- A graph (line chart) showing the curves for high, average, low and delta values for the day. These four items are selected on the left side of the graph. High, Average and Low daily values are displayed on the graph by default.
- A table with daily average, delta (difference between maximum and minimum value), maximum value with time stamp and minimum value with time stamp.
- A table with daily maximum and minimum with time stamp.

Not Available (N/A) data are not included in the graph but are presented in the table. Daily values are recorded for a maximum of 31 days. All data is retained during a system reboot but is not retained if the unit is depowered. Select **System Information** on the top menu and then choose **Reset** on the left submenu to reset the channel's daily statistics. Select **Erase Daily Statistics** for one channel and enter the channel mnemonic to reset.

Following is an example of what the user will see when clicking on an analog mnemonic, the F1A1 channel:



5.1.7 History for mnemonics representing binary values

Clicking on the mnemonic displays the mnemonic history for the last 31 days for each mnemonic representing binary status. Date and time with values and Occurrence counter are displayed.

Following is an example of what the user will see when clicking on a binary mnemonic, the GT3E1 channel (SNMPget module 3, binary channel 1):

FUSION

Logout

Alarms | Views | I/O Channels | Derived Channels | File Transfer | System Information | Links | Config | HMI Views | Charts

FUSION Trial

CR: MAJ: MIN: INF:

Back

Menu

- Fusion - I/O Channels
- Module 2 - AC Mains
- Module 3 - Server Room
- Module 4 - CELL 1
- Module 5 - CELL 2
- SNMPget 1 - MIRADOR(37)
- SNMPget 2 - SITEVIEW(38)
- SNMPget 3 - CORDEX(35)

GT3E1 - DIGITAL INPUT 1

History	Date and Time	Value	Occurrence Counter
	19/02/2012 17:19:18	OFF	0
	19/02/2012 02:06:02	OFF	0
	19/02/2012 02:05:00	NA	0
	19/02/2012 14:14:33	OFF	0
	19/02/2012 13:58:33	NA	0
	19/02/2012 13:57:23	OFF	0
	19/02/2012 13:27:30	ERR	0
	19/02/2012 13:26:14	DIS	0
	19/02/2012 13:22:13	ERR	0
	19/02/2012 13:19:55	OFF	0

Date and Time stamp

Mnemonic statuses and number of occurrences

5.1.8 File transfer

The download page:

FUSION

Logout

Alarms | Views | I/O Channels | Derived Channels | File Transfer | System Information | Links | Config | HMI Views | Charts

TEMPLATE 1 HVAC R-410

CR: MAJ: MIN: INF:

Back

Menu

- Download
- Upload
- File Management

Download

File Name
Configuration file
ASO Configuration file
History Log file
System Log (SYSLOG)
Triggered Statistics
Triggered Statistics (Protected)
Peak Statistics
Histogram Statistics
Daily Statistics file
Daily Statistics file all channels
Image Files <ul style="list-style-type: none">Diagnostic XMIGHVACx2 View2.XMIG

All these files can be downloaded to Excel™

The **Upload** page:

The screenshot shows the 'Upload' page in the FUSION interface. Callouts point to various sections:

- Fusion's operating parameters**: Points to the 'Configuration File' under 'Miscellaneous Files'.
- Engineering Notes or Site Inventory saved in FUSION**: Points to the 'NOTE File' under 'Miscellaneous Files'.
- FUSION's card codes**: Points to the 'FUSION Code' under 'Firmware Code'.
- Expansion Shelf's card**: Points to the 'Card Code' under 'Firmware Code'.
- Modules code for the Smart Module Expansion (48BI and 24BI)**: Points to the 'SMX Modules Code' under 'Firmware Code'.
- Images for HMI views files**: Points to the 'Image File (XMG)' under 'Miscellaneous Files'.
- To transfer a SSH private key to the FUSION**: Points to the 'SSH RSA Private Key' under 'Security Keys'.
- For HTTPS secure communication (TLS/SSL protocol)**: Points to the 'SSL Private Key' and 'SSL Certificate' under 'Security Keys'.

Warning text at the bottom: "WARNING! Upload of new configuration file may reboot FUSION. Upload of new firmware (code) will reboot FUSION after transfer is completed and may reset card. Clicking anywhere on a page will interrupt the firmware update."



IMPORTANT:

- Uploading a file is not possible when another user is in **Config** mode.

The **File management** page:

The screenshot shows the 'File Management' page in the FUSION interface. Callouts point to specific files:

- Code files for the Expansion shelf's analog, event and output cards**: Points to the 'MIR_ANA.XMD', 'MIR_EVT.XMD', and 'MIR_OUT.XMD' files.
- Custom made HMI**: Points to the 'BATTERIE.XMG' file.

File Name	Size	Action
MIR_ANA.XMD	60160 Byte	Erase
MIR_EVT.XMD	4992 Byte	Erase
MIR_OUT.XMD	3968 Byte	Erase
Comm Room.XMG	51328 Byte	Erase
Global Site.XMG	68736 Byte	Erase
VZ-16k Swch-pt.XMG	76672 Byte	Erase
Power View.XMG	60288 Byte	Erase
BATTERIE.XMG	60672 Byte	Erase
HVACx2 View.XMG	72448 Byte	Erase
Rogers Cooling.XMG	123264 Byte	Erase
AC Mains.XMG	58112 Byte	Erase
Note.TXT	768 Byte	Erase

5.1.9 System information

The HTTP(S) interface **System Information** menu enables the user to quickly access useful information.

Information on communication port settings

Current CRAFT ports and network communication ports settings can be displayed by selecting the port. This enables the user to get the information required without having to go into the **Config** menu. This is useful also for a USER with no Supervisor access that has no access to the **Config** mode. Following is a view of a configured Ethernet port:

The screenshot shows the FUSION web interface with the 'Ethernet' port selected. The page includes a navigation menu on the left and a table of port information on the right.

Menu	Ethernet
Front RS-232/USB	Port Information
Rear RS-232	IP Address
Rear RS-485	Subnet Mask
Rear MLINK	Gateway
Ethernet	Ethernet Speed
Memory / CPU	Cable Type
Modules	MAC Address
Version	
Network Time (NTP)	
SNMP	
Date and Time	
Reset	

Version and memory/CPU

The software and hardware release numbers and statuses for each hardware component of the FUSION can be polled using the **Version** submenu.

The Version Submenu

The screenshot shows the FUSION web interface with the 'Version' submenu selected. The page displays a table of versions for various hardware components.

Menu	Versions
Front RS-232/USB	Card/Module
Rear RS-232	Version
Rear RS-485	Status
Rear MLINK	Software Version
Ethernet	EXP2 I/O module
Memory / CPU	EXP2 I/O module
Modules	LED Front Panel
Version	Internal modem
Network Time (NTP)	I/O Card 1 :
SNMP	I/O Card 2 :
Date and Time	I/O Card 3 :
Reset	I/O Card 4 :
	I/O Card 5 :
	I/O Card 6 :
	I/O Card 7 :
	I/O Card 8 :
	I/O Card 9 :
	I/O Card 10 :
	I/O Card 11 :
	I/O Card 12 :
	I/O Card 13 :
	I/O Card 14 :
	I/O Card 15 :

The **Memory/CPU** submenu may be used to view FUSION's remaining memory capacity. It provides information of the remaining capacity percentage for the following type of memories:

- Read Only
- Read Write
- RB (Read Write Battery Backup)
- Configuration (Memory range allowed for the configuration file)

It also provides processor total utilization percentage and also FUSION's CPU derived channel processing.

The **Memory/CPU** submenu

Memory / CPU	
Memory	% Left
Read Only	34
Read/Write	15
RB	11
Configuration	95
Resource	% Used
CPU Utilization	0
Derived channel processing	0

Status of the MODBUS Modules

If MODBUS modules are configured in FUSION, their configuration parameters are displayed in the **Modules** submenu.

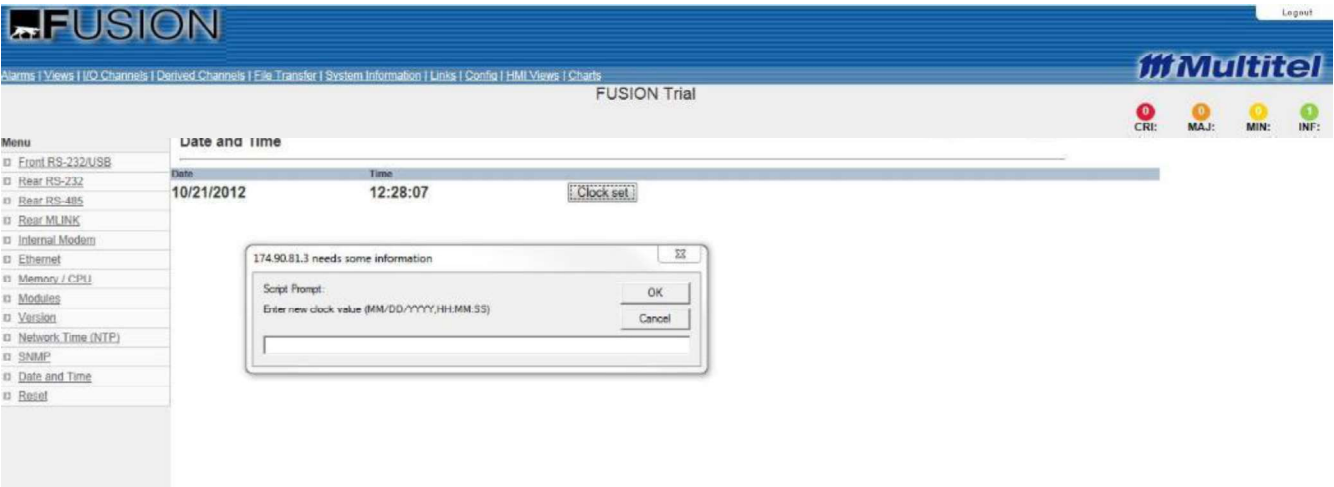
The **Modules** submenu

Modules	
Module 1	SMX Analog
State	Enabled
Protocol	Modbus RTU
Port	RS485 Back Port
Slave ID	5
Application update	----
Communication statistics	Total: 43107, Error rate: 100.00%
Module 2	AC Mains
State	Enabled
Protocol	Modbus RTU
Port	MLINK Port
Slave ID	2
Time out	1
Communication statistics	Total: 35681768, Error rate: 0.00%
Module 5	Midtronics
State	Disabled
Protocol	Modbus RTU
Port	RS485 Back Port
Slave ID	226
Time out	10
Communication statistics	Total: 0, Error rate: ----

Setting Date and time

The user can change the **Date and Time** of the FUSION device. Use the Date and Time submenu and click on the Clock set button and a window will appear asking the user to enter the new date and time in a pre-defined format.

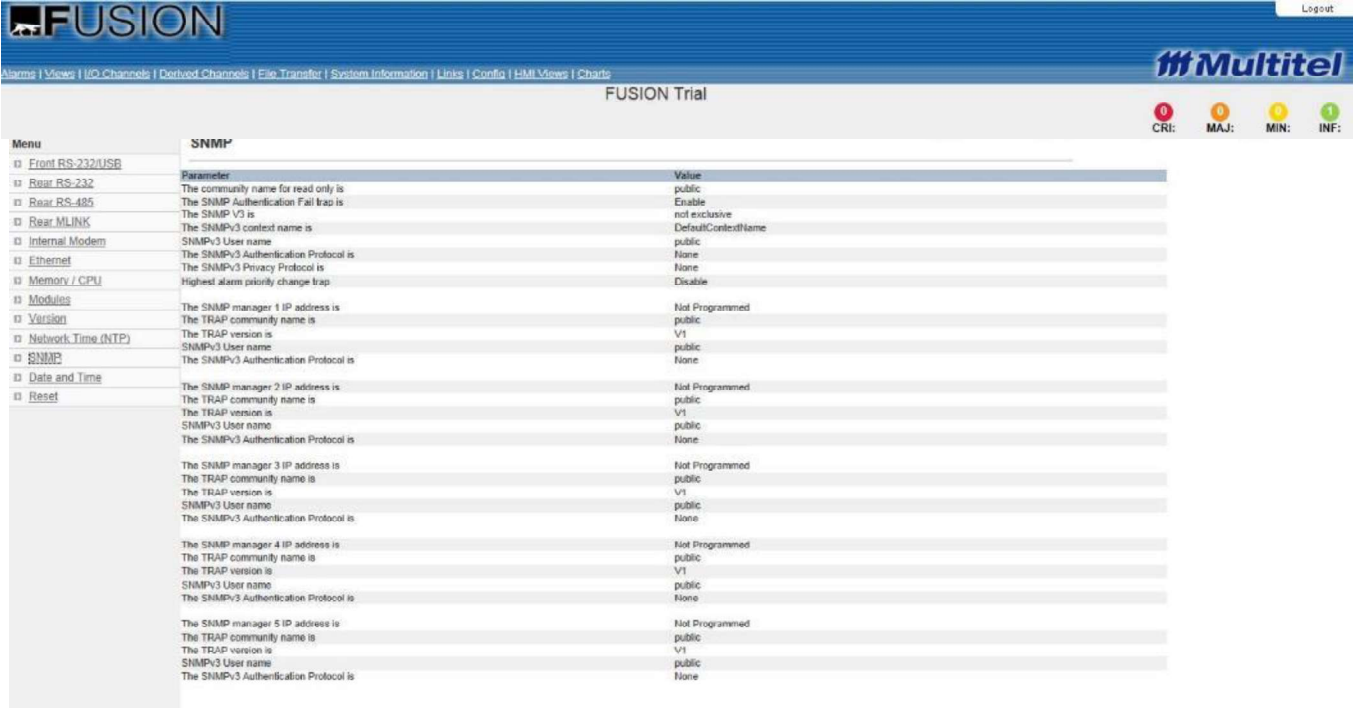
The **Clock set** dialogue box




Display of the Network Time (NTP) and SNMP parameter values

Like the communication ports the **NTP** and **SNMP** parameter values are accessible for display.

The **SNMP** Submenu



The Network Time (NTP) Submenu


Logout

[Alarms](#) | [Views](#) | [I/O Channels](#) | [Derived Channels](#) | [File Transfer](#) | [System Information](#) | [Links](#) | [Config](#) | [HMI Views](#) | [Charts](#)



MTQC175-2500: Multitel Demo unit located at 175-2500 Jean-Perrin Street, QC G2C1X1

8

1

2

24

CR1: MAJ: MIN: INF:

Menu

Front RS-232/USB

Rear RS-232

Rear RS-485

Rear MLINK

Internal Modem

Ethernet

Memory / CPU

Modules

Version

Network Time (NTP)


SNMP

Network Time (NTP)

Information

Protocol	Enabled
Offset from UTC	-5
Server 1 IP address	64.90.182.55
Server 2 IP address	Not Programmed
Synchronization frequency	1 day
Daylight Savings Time	Enabled

The **Event Analog Value** Submenu enables a user to view the voltage presence for each FUSION binary input channels



[Accueil](#) | [Vues](#) | [Canaux E/S](#) | [Canaux dérivés](#) | [Téléchargement](#) | [Information système](#) | [Liens](#) | [Configuration](#) | [Vues HMI](#) | [Graphiques](#)

[Déconnexion](#)

Menu

- RS-232C/USB frontal
- RS-232 arrière
- RS-485 arrière
- MLINK arrière
- Ethernet
- Mémoire / CPU
- Modules
- Version
- Temps Internet (NTP)
- SNMP
- Date et heure
- Reset
- Valeurs analogiques des évènements

VF1E

CR: 1 **MAJ:** 5 **MIN:** 1 **INF:** 7

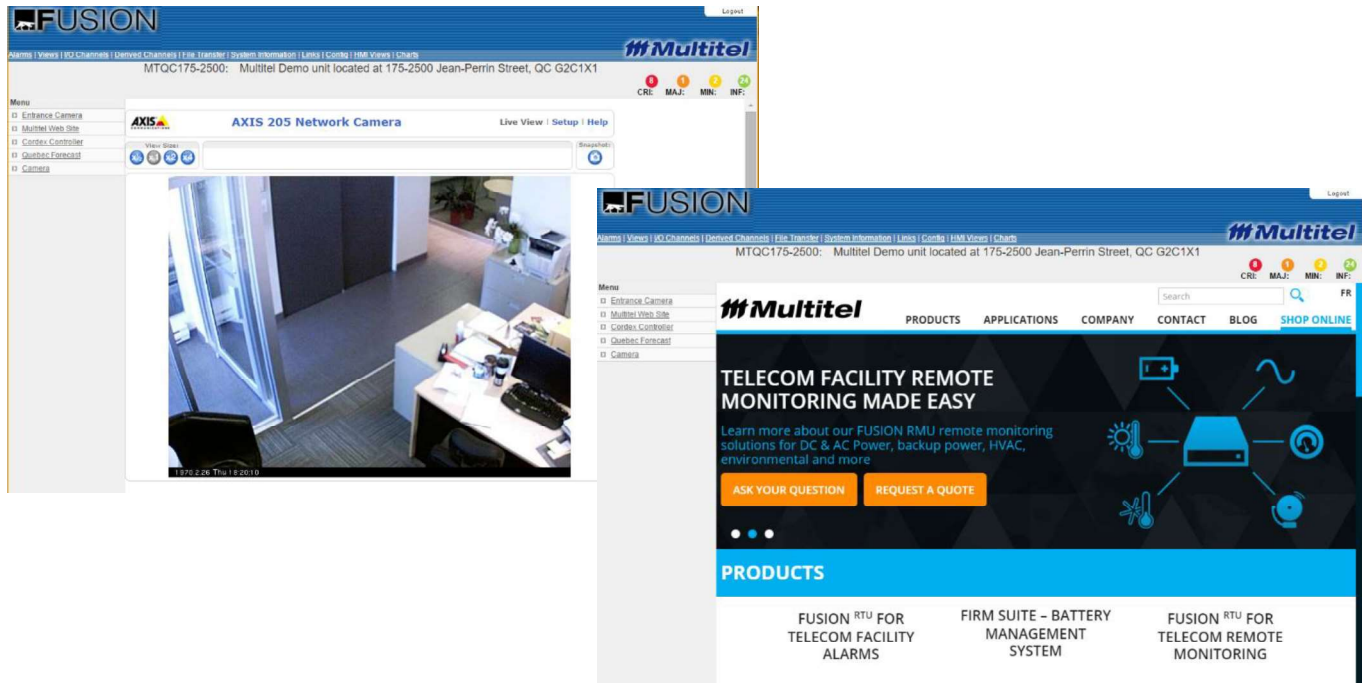
[← back](#)

F1E1 10.2 V OFF	F1E2 0.3 V ON	F1E3 10.2 V OFF	F1E4 10.2 V OFF	F1E5 10.2 V OFF	F1E6 10 V OFF	F1E7 10.1 V OFF	F1E8 10.2 V OFF
F1E9 10.2 V OFF	F1E10 10.1 V OFF	F1E11 10.2 V OFF	F1E12 10.2 V OFF	F1E13 0 V DES	F1E14 0 V DES	F1E15 10.2 V OFF	F1E16 10.2 V OFF
F1E17 10.2 V OFF	F1E18 10.2 V OFF	F1E19 10.2 V OFF	F1E20 10.2 V OFF	F1E21 10.2 V OFF	F1E22 10.2 V OFF	F1E23 10.2 V OFF	F1E24 10.2 V OFF
F1E25 10.2 V OFF	F1E26 0 V DES	F1E27 0 V DES	F1E28 10.2 V OFF	F1E29 10.2 V OFF	F1E30 0 V DES	F1E31 0 V DES	F1E32 0 V DES
F1E33 0 V DES	F1E34 0 V DES	F1E35 0 V DES	F1E36 0 V DES	F1E37 0 V DES	F1E38 0 V DES	F1E39 0 V DES	F1E40 0 V DES
F1E41 0 V DES	F1E42 0 V DES	F1E43 0 V DES	F1E44 0 V DES	F1E45 0 V DES			

For **Reset** submenu, refer to section [3.15](#)

5.1.10 Links

Under the **Links** menu, the user can configure URL links for useful information to be accessed through FUSION HTTP(S) interface. Multitel's HTTP(S) site is a good example of a useful link that can be configured in the **link** section.



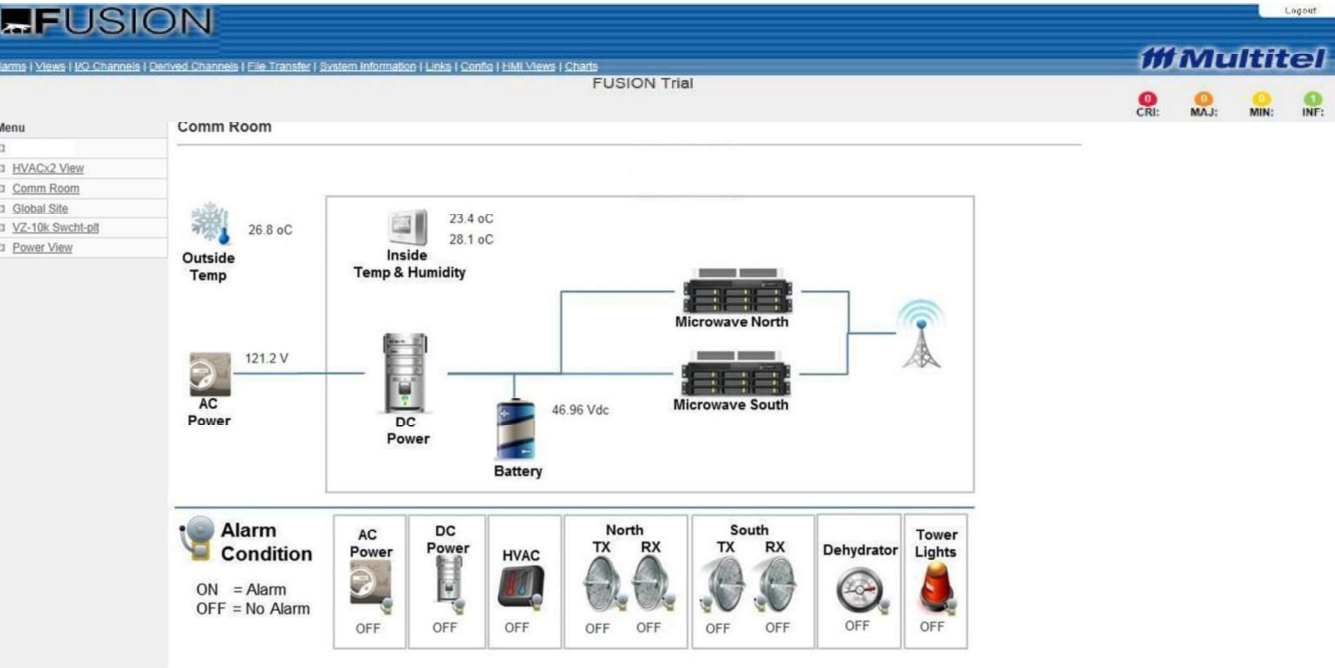
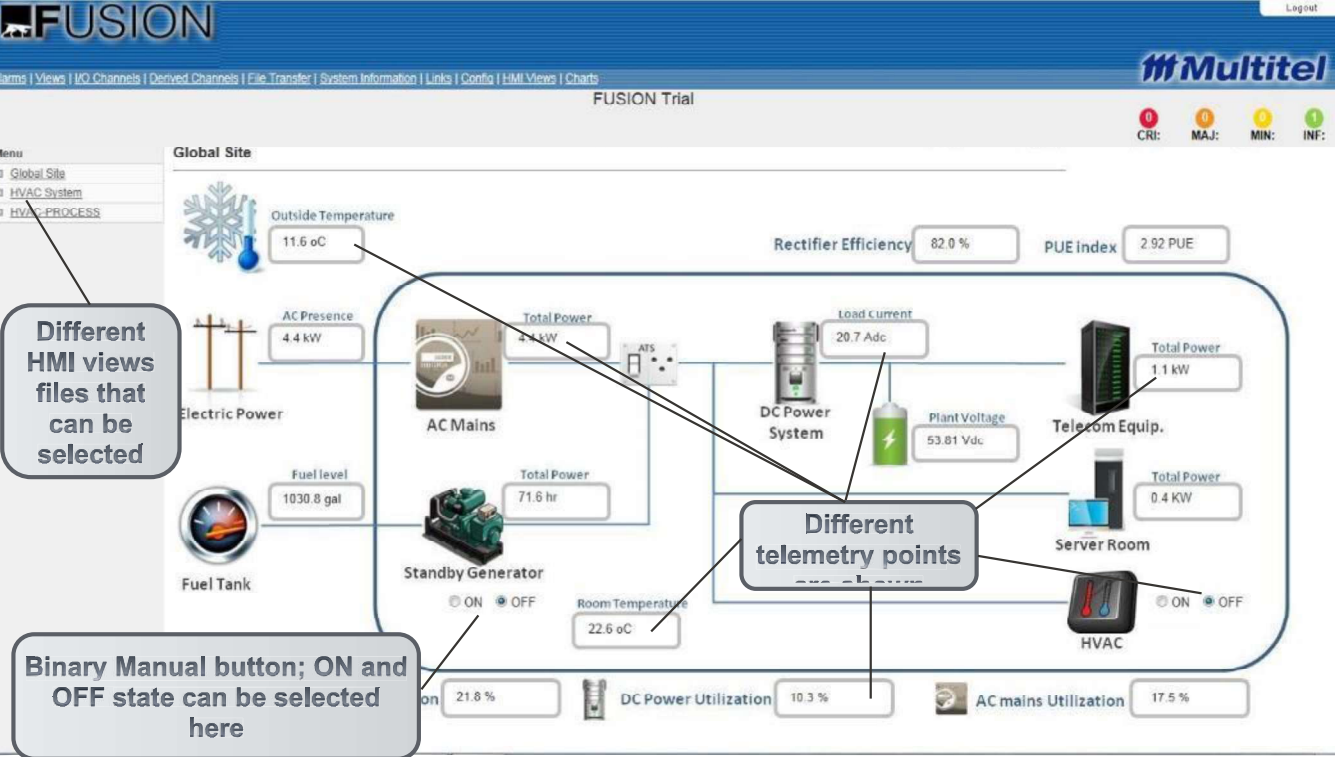
5.1.11 HMI Views (Human Machine Interface)

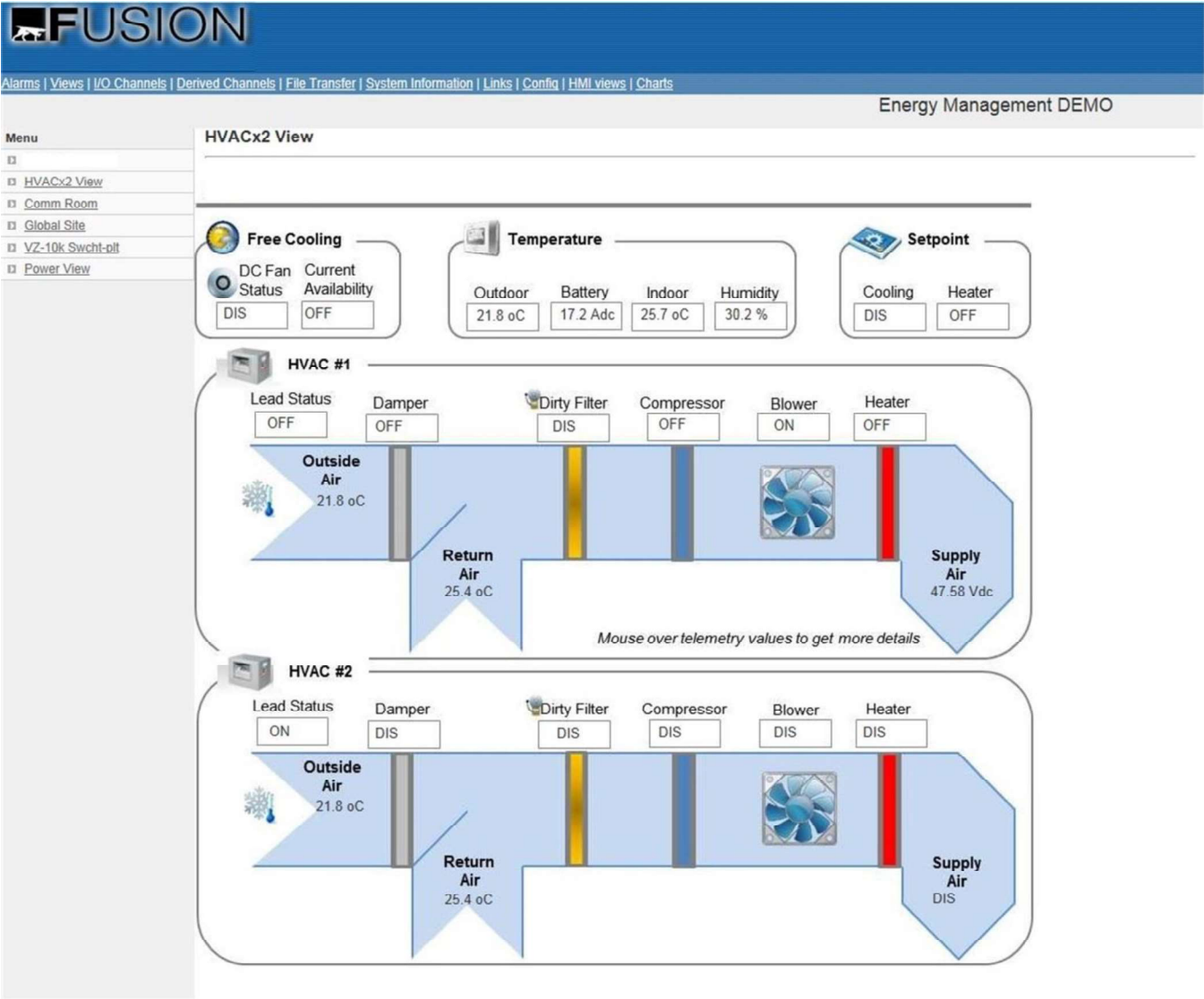
FUSION's HMI Views are user defined; refer to section 6.4 for information on the files.

To display HMI image views, click on the **HMI views** from the top menu and select one of the image file on the left submenu. If the home page function has been enabled in the "General System Parameter" function, the selected HMI file is displayed as the FUSION's home page. All Images under the HMI views are available even if the home page function is disabled.

See examples below...

Following are some examples of HMI view applications:

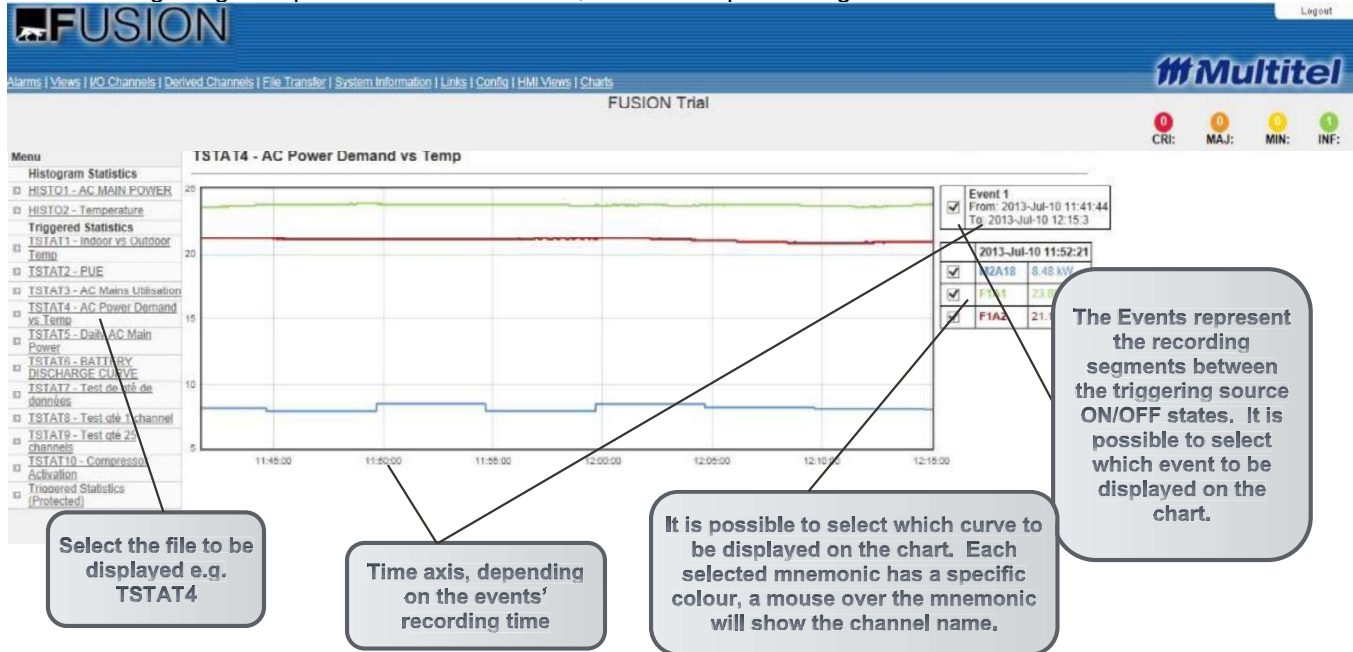




5.1.12 Charts (Line charts)

The **Charts** function on the top menu of the HTTP(S) interface enables the user to display the preconfigured Triggered statistics files content on a on-line chart graph.

The following images explain how it works. First, the chart representing TSTAT2 file:



5.2 COMMAND LINE INTERFACE (ASCII PROTOCOL)

Although the HTTP(S) interface is generally used for connection to the FUSION, the Command Line Interface may also be utilized for temporary connection to FUSION. This enables the user to view the status of critical parameters such as voltage, current, temperature and equipment alarms or other parameter statuses. Depending on user access rights the user can make changes to operating parameters such as communication settings or I/O channel settings and to perform basic tests.

5.2.1 Terminal communication session (TELNET or SSH)

For FUSION remote access through PSTN network (Public Switched Telephone Network) a Hayes compatible modem and commercial communication software can be used that support VT-100 emulation and binary transfer using XMODEM protocol.

A dumb terminal or any computer equipped with communication software can be used to access FUSION via modem or serial port. To use the Ethernet port with the TELNET option enabled, software like Procomm Plus™, Hyperterminal™ or Putty™ are required. When the SSH option is enabled Putty™ is recommended.

TELNET is a client-server protocol based on a reliable connection-oriented transport. FUSION supports both ports 23 and 2000. However Multitel recommends the use of port 23 when Telnetting as port 2000 is reserved for FIRM Suite™. When communication is established a user name and password is requested at the LOGIN. FUSION will maintain this session until the "DISC" command is entered or the inactivity timer determines a timeout.

SSH is similar to TELNET; it takes what you type and sends it across the network to a remote computer. SSH however uses encryption so unlike TELNET, the information passing over the network is not understandable if seen by an observer. FUSION supports TCP port 22 for SSH. When communication is established a user name and password is requested at the LOGIN. FUSION will maintain this session until the "DISC" command is entered or the inactivity timer determines a timeout.

The FUSION command line interface is used to view and configure FUSION features and parameters. Backup, restore and upgrade procedures involving CSV file transfer that uses XMODEM may also be performed via a TELNET and SSH sessions using the Ethernet port or in terminal mode via one of the other available ports.

5.2.2 Login sequence

The login sequence is the same for every FUSION communication port. However when serial ports (front RS-232, back RS-232 or RS-485) are used the user will need to strike the enter key three (3) times in order to get the FUSION header. When using a Data Terminal Ready (DTR), a modem or an Ethernet connection, the FUSION header displays as soon as a connection or activation is detected.

When communication is established with FUSION an introduction header followed by a user name and password request is displayed. The prompt ">" is then displayed indicating that the system is ready for a command. Use the "H" or "HELP" command to display all available commands as well as a brief description of each.

The "LOG" command may be used to log out and change user or access level without disconnecting from the system.

Multitel recommends that a login password be created. If this password is forgotten, Multitel Technical Support can reset it.

5.2.3 Logout sequence

Any user can log out at any time by using the “Escape” key to reach the prompt “>” and by typing the “DISC” command.

For security reasons, FUSION is equipped with an inactivity timer that monitors user activity. If the timer expires FUSION will automatically terminate the communication session. On a modem connection, this feature eliminates expensive telephone bills if the connection remains up for a long duration. The inactivity timer delay is programmable for each system user via the “USER[x]” command. Press the enter key to reset the inactivity timer or when prompted by “Inactivity timer has expired, disconnection in 35 seconds”.

5.2.4 Editing parameters

FUSION comes fully configured as defined according to each customer specifications. Some minor adjustments to specific parameters will be made to sites or application specificities such as Shunt Scaling factors. Editing the parameters must be performed using the “CONFIG” command to activate the configuration mode and autosave mode. Each parameter is automatically saved using the “ENTER” key.

To activate the “CONFIG” mode, the user logged in must have SUPERVISOR level access and specific commands can be entered to set user preferences or initiate actions.

5.2.5 Available commands (HELP)

Type the “HELP” command to view online the list of available commands (the following tables show the command list depending on the user access level). The list is displayed in alphabetic order and displayed in 3 categories: Configuration, Display and Utility. Some commands are listed in more than one category.

Table 34 - Configuration commands for different user levels

Mnemonic	Description	Supervisor	User	Viewer
AAR[x]	Analog arithmetic channels	X	X	X
ACHR[x]	Time totalizer (chronometer)	X	X	X
ACTL[x]	Access control channels (HID card reader).	X		
ANALOG	Analog channels: Real, Virtual, Chrono, WattHour (DC), analog arithmetic, constant	X	X	X
APPLY	Apply configuration modifications	X		
AUDIBLE	Alarms that will generate an audible alarm	X	X	X
AWH[x]	Watt hour accumulator	X	X	X
BMSTATE[x]	View and control binary manual states	X	X	X
BM[x]	Binary manuals	X	X	X
C[x]A[y]	Real analog card channels (Expansion Shelf cards)	X	X	X
C[x]E[y]	Event card channels (Expansion Shelf cards)	X	X	X
C[x]O[y]	Output card channels (Expansion Shelf cards)	X	X	X
C[x]V[y]	Virtual analog card channels (Expansion Shelf cards)	X	X	X
CALLOUT[x]	Callouts	X	X	X
CLOCK [-R]	View and set date/time	X	X	X
COM	Communication ports	X	X	X
CONFIG	Access configuration mode	X		
CONST[x]	Constant channels	X	X	X
CSTAT	Statistic files	X	X	X
CVIEW[x]	Programmable views	X	X	X
C[x]	I/O cards (Expansion Shelf cards)	X	X	X

Mnemonic	Description	Supervisor	User	Viewer
DCC[x]	Duty cycle or average channels	X		
DELAY[x]	Programmable delays	X	X	X
DISP	MODBUS display configuration	X	X	X
DB[x]	Dialup Bridge configuration	X	X	X
EMAIL	EMAIL protocol	X	X	X
EVENT	Event card channels	X	X	X
EXIT	Exit configuration mode	X		
F[x]A[y]	FUSION real analog channels	X	X	X
F[x]E[y]	FUSION event channels	X	X	X
F[x]O[y]	FUSION output channels	X	X	X
F[x]	FUSION modules (EXPx cards)	X	X	X
GT[x]A[y]	SNMPget analog channels	X	X	X
GT[x]E[y]	SNMPget Event channels	X	X	X
GT[x]	SNMPget channels	X	X	X
G[x]	Groups	X	X	X
LED[x]	Front panel LEDs	X	X	X
LINK[x]	URL links	X	X	X
LKU[x]	Lookup Table channels	X	X	X
M[x]A[Y]	Module analog channels	X	X	X
M[x]E[y]	Module event channels	X	X	X
M[x]O[y]	Module binary output channels	X	X	X
M[x]R[y]	Module analog output channels	X	X	X
MODULE[x]	Modules configured on MODBUS RTU protocol	X	X	X
OUTPUT[x]	Output channels	X	X	X
PID[x]	Derived PID channels	X	X	X
PING [x]	PING (accessibility of an internet device)	X	X	X
RADIUS	RADIUS protocol parameters	X	X	X
SCH[x]	Schedule (HID card reader)	X		
SLOGCFG	SYSLOG protocol	X	X	X
SNMP	SNMP protocol	X	X	X
SYS	General system parameters	X	X	X
TH[x]	Thresholds	X	X	X
TSP[x]	Time Set Points	X	X	X
USER[x]	System users	X	X	X

Table 35 - Display commands for different user levels

Mnemonic	Description	Supervisor	User	Viewer
?	View active alarms	X	X	X
ASTATE[-R]	View analog channel values	X	X	X
BMSTATE[x]	View and control binary manual states	X	X	X
CHAN[-R]	View channel values	X	X	X
CLOCK [-R]	View and set date/time	X	X	X
CPU	Display CPU utilisation	X	X	X
DAILY	View daily data logs for analog channels	X	X	X
DIR	View file information	X	X	X
ESTATE[-R]	View event channel states	X	X	X
HIST	View binary data logs	X	X	X
MEM	Display remaining memory capacity	X	X	X
MODREAD	Read a value from a module register	X	X	X
MODWRITE	Write a value to a module register	X		
OSTATE[-R]	View binary output channel states	X	X	X
REMFIL	List file in the system and allow to delete one of them	X	X	X
STAT	View analog data logs	X	X	X

Mnemonic	Description	Supervisor	User	Viewer
SYSLOG	View connections to the system log file	X	X	X
VERSION	View all subsystem component versions	X	X	X
VIEW[x][-R]	Display programmable views	X	X	X

Table 36 - Utility commands for different user levels

Mnemonic	Description	Supervisor	User	Viewer
ACO	Alarm Cut OFF	X	X	
APPLY	Apply configuration modifications	X		
CALIBR	Display analog modules calibration report	X	X	X
CALIBRATION	Calibrate analog channels	X		
CONFIG	Access the configuration mode	X		
CPU	Display CPU utilisation	X	X	X
DISC	Disconnect	X	X	X
DOWNLOAD[x]	Begin XMODEM reception of a configuration, statistics or historical file	X	X	X
ERRFILE	Display configuration error	X	X	X
EXIT	Exit configuration mode	X		
HUB	Hub between ports	X		
LOG	Log into the system (switch users without having to disconnect)	X	X	X
MACHINE	Switch to MACHINE protocol	X		
MEM	Display remaining memory capacity	X	X	X
MODREAD	Read a value from a module register	X	X	X
MODWRITE	Write a value to a module register	X		
NOTE	Display NOTE file data	X	X	X
REMFILE	List file in the system and allow to delete one of them	X	X	X
RESET	Reset for different functions	X	restricted	restricted
UPLOAD	Begin XMODEM transfer of a configuration file to the unit	X		

[-R]: Corresponds to a continuous refresh of all displayed values on screen.

5.2.6 File transfer

The transfer protocol used is XMODEM. All files are CSV format and offer compatibility with most commercially available spreadsheets on the market such as Microsoft™ Excel.

If the file does not link where each parameter appears in a different cell the user will need to close the file and adjust the “list separator” parameter in Regional Settings of the Windows control panel.

XMODEM Protocol:

XMODEM is one of the most popular file-transfer protocols. Although XMODEM is a relatively simple protocol it is very effective in detecting errors during data transfers. It works by sending blocks of data together with a checksum then waiting for acknowledgment of the block receipt. The acknowledgement step slows down the data transmission rate but it ensures more accurate transmission. Many modems and almost all communication software packages support XMODEM.

Uploading the Configuration File:

The FUSION configuration file can be sent to a device for an update using the “UPLOAD” command. Once this command is entered, the user must then upload a CSV file using the XMODEM protocol. Once the file transfer is complete, the “ERRFILE” command will list any errors.



- The IP address must be entered manually into the FUSION text interface. Uploading the configuration file does not overwrite the configured IP Address.
- Do not forget to set the binary file transfer protocol to XMODEM.

Refer to the communication software user manual to access the binary file reception and transmission functions.

Downloading Binary Files:

Configuration, statistics and history files can be transferred from the FUSION unit using the “DOWNLOAD” command. Once this command is entered, the user must then download a CSV file using the XMODEM protocol.

When using the “DOWNLOAD” command a list of available files to download is displayed:

1. Configuration file
2. ACC Configuration file
3. History log file
4. System log (SYSLOG)
5. Triggered Statistics (up to 10 individual files)
6. Triggered Statistics protected
7. Peak Statistics
8. Daily Statistics file
9. Note File



IMPORTANT:

- Do not forget to set the binary file transfer protocol to XMODEM.
- Refer to the communication software user manual to access the binary file reception and transmission functions.

6 STATISTICS AND LOG FILES

FUSION can be configured so that the user can download and view historical and statistical data. All files are CSV format ("Comma Separated Value") and are compatible with most commercially available spreadsheets on the market such as Microsoft™ Excel.

Analog and derived channel daily statistics can also be viewed directly online in tables and line charts by clicking on the channel's mnemonic (see section 6 Graphic and daily statistics for mnemonics representing analog values).

This section covers all FUSION's statistical and historical files, examples of exported files in Microsoft™ Excel and charts.

6.1 WORKING WITH STATISTICAL DATA

FUSION can manage various types of statistics for analog and derived channels.

Examples:

- Daily "highs and lows" on a continuous basis for all analog and derived channel for the last 31 days
- Performing peak studies on a long period of time
- Evaluating data distribution of specific analog or derived channels for a specific time period
- Automatically trigger recording battery voltage, current and Amp/hr over a discharge period
- Performing trend studies based on triggered conditions

Statistics can be viewed on the HTTP(S) interface. The list of statistic files available for download can also be displayed by choosing **Download** on the left submenu of the **File Transfer** top menu.

The statistic files are:

- Triggered Statistics (up to 10 files)
- Triggered Statistics (Protected)
- Daily Statistics file
- Daily Statistics file all channels
- Peak Statistics

6.1.1 Setting detailed triggered statistic files

The first two items on the above list are detailed statistics files. The Triggered Statistics is for general use. This file starts recording data when the trigger source state becomes true. The data is stored in volatile memory and will not be saved if there is a power loss or a reboot. These files have two (2) sampling periods each with a configurable sampling rate. The maximum number of samples for each channel is 2000.

Each detailed triggered statistic file is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Triggered Statistics** on the left submenu. Then select one of the 10 **TSTAT[x]** files. A list of programmable parameters will be displayed.

Table 37 - TSTAT[x] File Configuration Parameters

Parameters	Description	Default Value
Data logging description	File identification. (Up to 40 characters)	Not Programmed

Parameters	Description	Default Value
Triggering source	Triggering source used to activate data recording. E.g., BM1 or !BM3 are possible triggering sources. All possible triggering sources are listed in Table 31 and Table 32 . When the triggering source goes OFF the recording is ended it will continue recording with another OFF to ON transition.	
Sampling rate for period 1	Select: 1 to 65535 seconds	15 seconds
Number of samples for period 1	The maximum number of samples for each channel is 2000. The choice made in this parameter will also assign the number of samples for period 2. Select: 0 to 1000	480
Sampling rate for period 2	Select: 1 to 65535 seconds	60 seconds
List of channels to monitor	A maximum of 25 channels can be programmed. Each programmed channel is allocated one specific colour. Both analog and binary channels are allowed and can be programmed on the same graph. If only binary channels are programmed, the values are 0 and 1. In the case of a mixed selection of analog and binary channels, the binary channels are converted into analog values. In case of channel failure, the value of the affected channel is set to zero.	

To download a **TSTAT[x]** file click on **File Transfer** on the top menu and then choose **Download** on the left submenu. Select the **TSTAT[x]** file to be download and the retrieved files can then be opened into a Microsoft™ Excel spreadsheet.

Following is an example of a TSTAT2 file exported into Excel.

File Configuration Parameters

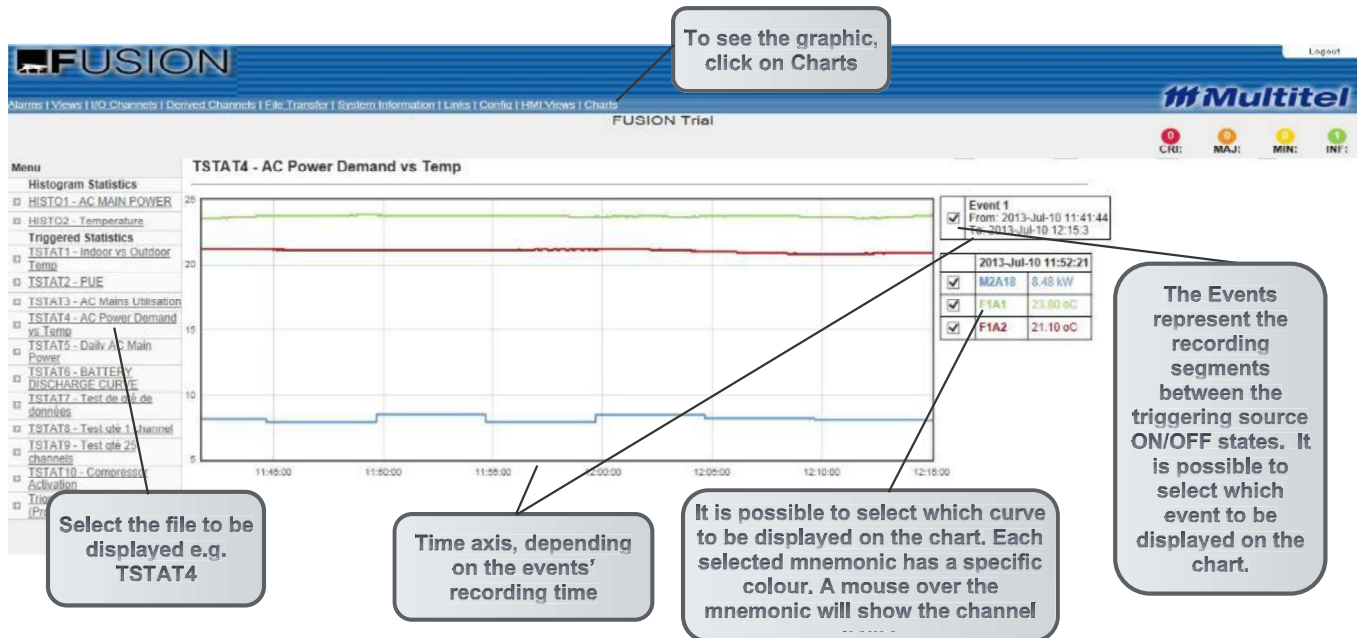
The screenshot shows the FUSION web interface with the 'Triggered Statistics' configuration page for TSTAT2. The page includes a menu on the left, a top navigation bar, and a main configuration area. Callouts explain the parameters:

- File mnemonic:** Points to 'TSTAT2' in the configuration list.
- File descriptive name:** Points to 'FUE' in the configuration list.
- BM1 triggering source is used to start recording (ON status) and stop recording (OFF status):** Points to 'BM1' in the configuration list.
- First period sampling rate. I.e. the value will be written in the file every 3600 seconds (every hour for the next):** Points to '3600 seconds' in the configuration list.
- After the first 1000 samples, the data (AAR16) will be written to the file every hour until it reaches a maximum number of samples of 2000 or until BM1 goes OFF:** Points to '1000' in the configuration list.

Excel File

	A	B	C	D
1				
2	Multitel Inc.			
3	FUSION			
4	Software Version	4.50B06		
5	Unit	Energy Management DEMO		
6	10/31/2012 11:01:49			
7	Detailed Data Logging	2		
8				
9	PUE	AAR16		
10		PUE		
11	Date Time	Power Usage Effectiveness		
12	12-10-29 15:24	4.74		
13	Code	0 Normal End		
14				
15	12-10-29 15:28	5.78		
16	Code	0 Normal End		
17				
18	12-10-29 15:28	10.05		
19	12-10-29 16:28	3.23		
20	12-10-29 16:28	8.31		
21	12-10-29 16:28	8.18		
22	12-10-29 19:28	5.89		
23	12-10-29 20:28	4.94		
24	12-10-29 21:28	2.91		
25	12-10-29 22:28	4.87		
26	12-10-29 23:28	3.24		
27	12-10-30 0:28	3.44		
28	12-10-30 1:28	1.21		
29	12-10-30 2:28	3.22		
30	12-10-30 3:28	4.34		
31	12-10-30 4:28	3.53		
32	12-10-30 5:28	4.35		
33	12-10-30 6:28	3.44		
34	12-10-30 7:28	2.89		
35	12-10-30 8:28	4.76		
36	12-10-30 9:28	4.87		
37	12-10-30 10:28	2.48		
38	12-10-30 11:28	1.66		
39	12-10-30 12:28	2.17		
40	12-10-30 13:28	4.1		
41	12-10-30 14:28	5.51		
42	12-10-30 15:28	4.12		
43	12-10-30 15:28	4.12		
44	12-10-30 16:28	4.53		
45	12-10-30 17:28	1.33		
46	12-10-30 18:28	4.56		
47	12-10-30 19:28	4.4		
48	12-10-30 20:28	3.53		
49	12-10-30 21:28	4.23		
50	12-10-30 22:28	4.95		
51	12-10-30 23:28	3		
52	12-10-31 0:28	3.51		
53	12-10-31 1:28	5.01		
54	12-10-31 2:28	3.25		
55	12-10-31 3:28	3.56		
56	12-10-31 4:28	5.03		
57	12-10-31 5:28	2.93		
58	12-10-31 6:28	2.8		
59	12-10-31 7:28	4		
60	12-10-31 8:28	3		
61	12-10-31 9:28	3.04		
62	Code	1 In Progress		
63				
64				

Select the **Charts** function from the top menu:



For more information on the Charts function refer to section 5.1.12.

6.1.2 Setting the BSTAT1 Protected Triggered Statistics file

This file is a protected triggered statistics file. Although it can be used for other purposes this feature was specifically designed to record battery discharge data. The data is stored in memory with an on-board battery backup. The data will not be lost in the event of a power loss or a system reboot. Up to 25 analog channels can be included in a chart and the file is saved as BSTAT1. The file has two (2) acquisition periods with a fixed sampling rate of 15 seconds for the first period and 60 seconds for the second period. The first period is configurable with samples from 0 to 1000 where 1000 is the upper limit for each channel. Once you have defined the number of samples for period 1, period 2 automatically gets the difference. I.e. 1000 minus number of samples in period 1.

BSTAT1 file is programmable. Click on **Config** from the top menu (Supervisor access only) and then choose Triggered Statistics (protected) on the left submenu. **BSTAT1** file will be available for configuration.

Table 38 - BSTAT1 File Configuration Parameters

Parameters	Description	Default Value
Data logging description	File identification. (Up to 40 characters)	
Triggering source	Triggering source used to activate data recording. E.g., BM1 or !BM3 are possible triggering source. All possible triggering sources are listed in Table 31 and Table 32. When the triggering source goes OFF, the recording is ended. It will continue recording with another OFF to ON transition.	

Parameters	Description	Default Value
Number of samples for period 1	The maximum number of samples for each channel is 1000. Select: 0 to 1000	480
List of channels to monitor	A maximum of 25 channels can be programmed. Each programmed channel is allocated one specific colour. Both analog and binary channels are allowed and can be programmed on the same graph. If only binary channels are programmed, the values are 0 and 1. In the case of a mixed selection of analog and binary channels, the binary channels are converted into analog values. In case of channel failure, the value of the affected channel is set to zero.	

To download the **BSTAT1** file, click on **File Transfer** on the top menu and then choose **Download** on the left submenu. Select **Triggered Statistics (Protected)** then the downloaded files can be opened into Microsoft™ Excel.

To reset triggered statistic files click on **System Information** from the top menu and then choose **Reset** on the left submenu and select the file required. These files can be viewed online on a graph using the **Charts** top menu of the HTTP(S) interface. See [section 5.1.12 Charts \(Line charts\)](#).

6.1.3 Setting daily statistic files list

Fusion records Daily Statistics for all analog inputs and few specific derived channels; i.e. Arithmetic, Watt-hour, Chronometer and PID. A Daily statistics list can be configured with up to 128 channels from this file for download purposes.

To configure the Daily statistic file (**DLIS1**) click on **Config** from the top menu (Supervisor access only) and then choose **Daily statistics channel list** on the left submenu. **DLIST1** will display for configuration.

Table 39 - DLIST1 File Configuration Parameters

Parameters	Description	Default Value
List of channels for downloading Daily Stats	All the selected channels to be downloaded into the Daily Statistic file. All analog input type and a few specific derived channels like arithmetic; WattHour, chronometer and PID can be downloaded.	

Time stamps are automatically recorded for each configured real analog channel and virtual analog channel for a period of 31 days. Channels available:

- Daily average value,
- Delta value (HV-LV),
- Daily maximal value with time stamp
- Daily minimal value with time stamp,
- Highest average value recorded on a one hour basis with time stamp
- and lowest average value recorded on a one hour basis

To download Daily Statistics from FUSION click on **File Transfer** from the top menu and then choose **Download** on the left submenu. Select **Daily Statistics file** or **Daily Statistics file all channels** and the retrieved files can be opened into Microsoft™ Excel. Following is an example:

PD	%	F1A1 AVG	Temperature Exterior Temp-02 Delta	HT	HV	LT	LV	SHT	SHV	SLT	SLV	AWH1 AVG	AC Mains kWh Delta	HT	HV	LT	LV	SHT	SHV	SLT	SLV
10/31/2012	97	12.9	4.0 oC	13:30:09	13.4	7:49:13	11.5	12:00:00	14.3	8:06:00	11.8	83.04	0 kWh	0:00:00	83.04	0:00:00	83.04	1:00:00	83.04	1:00:00	83.04
10/30/2012	100	12.2	6.4 oC	13:22:18	18.3	5:11:36	11.9	14:00:00	17.2	6:00:00	12.2	45.95	85.64 kWh	23:59:59	85.64	0:00:01	0.00085	0:00:00	85.75	1:00:00	1.938
10/29/2012	40	12.8	4.6 oC	14:17:38	15.4	17:37:02	10.8	15:00:00	13.2	18:06:00	11.4	44.06	0 kWh	14:25:22	44.06	14:25:22	44.06	15:00:00	44.06	15:00:00	44.06

The Daily Statistic file itself cannot be viewed online. However analog and derived channel daily statistics can be viewed individually in a chart or table format by clicking on the channel's mnemonic (see section 6 Graphic and daily statistics for mnemonics representing analog values)



- To reset the file click on **System Information** from the top menu and choose **Reset** on the left submenu. Select **Erase Daily Statistics for all channels** to erase all channels.
- DAILY statistics are stored in volatile memory and are not saved during a power loss but will be saved during a system reboot.

6.1.4 Setting peak statistics

Peak maximum and minimum value with time stamps are automatically recorded for each configured real and virtual analog channel.

Analog and derived daily statistic channels can also be viewed individually online in charts and tables by clicking on the channel's mnemonic (see section 6 Graphic and daily statistics for mnemonics representing analog values)

To download the Peak statistics file click on **File Transfer** from the top menu and then choose **Download** on the left submenu. Select **Peak Statistics** and open the file with Microsoft™ Excel.

Peak Statistics file in Excel

Columns may have to be widen to fit content

Software version

Unit name

File identification

Analog channels

Derived channels

MNEMO	NAME	UNIT	MIN VALUE	MIN DATE/TIME	MAX VALUE	MAX DATE/TIME
F1A1	Temperature Exterior Temp-02	oC	10.8	10/29/2012 17:37:02	15.4	10/29/2012 14:57:38
F1A2	Room Temperature	oC	20.7	10/30/2012 09:02:20	24.7	10/29/2012 14:42:01
F1A3	DC System Voltage	Vdc	46.95	10/29/2012 15:52:11	53.83	10/30/2012 08:27:43
F1A4	DC System Load	Adc	18.1	10/29/2012 15:53:56	20.7	10/30/2012 08:59:37
F1A5	Level	gal	1026.9	10/29/2012 16:30:48	1051.9	10/29/2012 16:36:43
F1A6	Temperature Exterior Temp-03	oC	10.7	10/29/2012 17:35:14	15	10/29/2012 14:57:53
F1A7	Temperature	oC	10.7	10/29/2012 16:01:07	35.6	10/29/2012 18:38:50
ACHR1	Generator Cumulative Runtime	Min	131.3	10/29/2012 14:25:22	131.3	10/29/2012 14:25:22
ACHR2	Open Door Cumulative	Min	0	10/29/2012 14:25:22	0	10/29/2012 14:25:22
ACHR3	Battery Discharge Cumulative	Min	0	10/29/2012 14:25:22	0	10/29/2012 14:25:22
AWH1	AC Mains pA Consumption	kWh	0.0008597	10/30/2012 00:00:01	44.06	10/29/2012 14:25:22
AWH2	AC Mains pB Consumption	kWh	0.0005436	10/30/2012 00:00:01	22.16	10/29/2012 14:25:22
AWH3	AC Mains pC Consumption	kWh	0.0005648	10/30/2012 00:00:01	23.51	10/29/2012 14:25:22
AAR1	AC Mains Total Consumption	kWh	2	10/30/2012 00:00:01	89735.1	10/29/2012 14:36:11
AAR3	AC Mains Total Draw	Amps	38.5	10/30/2012 01:43:34	168.4	10/29/2012 15:00:03
AAR4	AC Mains Total Utilization	%	19.3	10/30/2012 01:43:34	84.2	10/29/2012 15:00:03
AAR6	AC Mains Total Power	kW	0.8	10/29/2012 15:54:20	1.1	10/30/2012 08:59:38
AAR8	DC System Utilization	%	9	10/29/2012 15:53:56	10.4	10/30/2012 08:59:38
AAR12	Rectifier Efficiency	%	82	10/29/2012 14:25:22	82	10/29/2012 14:25:22
AAR13	Rectifier Utilization	%	15	10/29/2012 15:53:56	17.3	10/30/2012 08:59:38
AAR14	Non Essential Power	kW	NA	01/01/2000 00:00:00	NA	01/01/2000 00:00:00
AAR15	Facility Emmissions	kgCO2	1.167	10/30/2012 00:00:01	53213	10/29/2012 14:36:11
AAR16	Power Usage Effectvness	PUE	1.08	10/30/2012 05:00:23	13.44	10/30/2012 03:30:16
AAR19	Estimated Energy Cost	\$	0.264	10/30/2012 00:00:01	12025	10/29/2012 14:36:11
AAR20	DCIE	%	NA	01/01/2000 00:00:00	NA	01/01/2000 00:00:00
AAR22	Generator Utilization	%	24.2	10/30/2012 01:43:33	100.1	10/29/2012 23:08:12
AAR23	Fuel Tank Utilization	%	41.1	10/29/2012 16:30:48	42.1	10/29/2012 16:36:43
AAR26	Generator Estimated Autonomy	hr	71.3	10/29/2012 16:30:48	73.1	10/29/2012 16:36:43

Resetting the Peak Statistics file can be done two different ways. Click on **System Information** from the top menu and then choose **Reset** on the left submenu. Choose either **Erase Peak Statistics for one channel** or **Erase Peak Statistics for all channels**.



Peak statistics are stored in volatile memory and are not saved during a power loss but will be saved during a system reboot.

6.2 DISPLAYING HISTORY DATA FILES

The FUSION system supports two types of historic files used to record events: the history log file and the system log file. These files are setup to work together with a SYSLOG server (refer to section [10.5.15](#) for details on the SYSLOG protocol).

6.2.1 History log file

The History log file enables the user to view binary channel events. All data can be selected and displayed or data can be displayed by channel.

This file can store up to 85,000 values in chronological order. When the file reaches 85,000 values the oldest values are lost as new ones are added. The first 4,800 values are stored in battery backup memory. Data will not be lost in the event of a power loss or a system reboot. Values older than 4,800 values will be lost if the device is depowered. If the SYSLOG protocol is enabled, the values are automatically sent to the SYSLOG server as soon as they happen and they are also logged in the history log file.

Binary channel history can be displayed directly online by clicking on the channel's mnemonic.

To download the History log file, click on **File Transfer** from the top menu and then choose **Download** on the left submenu. Select **History log file** and open the file in Microsoft™ Excel.

History Log file in Excel

Columns may have to be widen to fit content

Software version

Unit name

File identification

Binary channel, with its status and number of occurrences with time stamp

Each time a binary mnemonic changes its status, it is logged into this file.

	A	B	C	D	E	F	G	H	I	J	K
1											
2		Multitel Inc.									
3		FUSION									
4		Software Version	4.50B06								
5		Unit	Energy Management DEMO								
6		10/30/2012 08:39:06									
7		History File									
8											
9	Channel	Name	Value	Occurrence	Date Time						
10	SUSER2	MULTITEL	ON	20	12-10-30 8:34						
11	PING1	Yves	OFF	22	12-10-30 7:59						
12	PING1	Yves	ON	22	12-10-30 7:55						
13	PING1	Yves		21	12-10-30 7:52						
14	PING1	Yves		21	12-10-30 7:49						
15	USER2	stephan		53	12-10-30 7:46						
16	USER2	stephan		53	12-10-30 7:33						
17	TH93	AC Mains Capacity Exceeded	OFF	293	12-10-30 3:30						
18	TH93	AC Mains Capacity Exceeded	ON	293	12-10-30 3:30						
19	TH93	AC Mains Capacity Exceeded	OFF	292	12-10-30 1:19						
20	TH93	AC Mains Capacity Exceeded	ON	292	12-10-30 1:19						
21	TSP2	1 Day TSP	ON	7	12-10-30 0:00						
22	TSP1	Daily AWH integral	ON	7	12-10-30 0:00						
23	TH93	AC Mains Capacity Exceeded	OFF	291	12-10-29 23:08						
24	TH93	AC Mains Capacity Exceeded	ON	291	12-10-29 23:08						
25	SUSER2	MULTITEL	OFF	19	12-10-29 21:24						
26	SUSER2	MULTITEL	ON	19	12-10-29 21:02						
27	SUSER2	MULTITEL	OFF	18	12-10-29 20:54						
28	SUSER2	MULTITEL	ON	18	12-10-29 20:10						
29	SUSER2	MULTITEL	OFF	17	12-10-29 20:05						
30	SUSER2	MULTITEL	ON	17	12-10-29 20:04						
31	USER2	stephan	OFF	52	12-10-29 19:51						
32	USER2	stephan	ON	52	12-10-29 19:30						
33	USER2	stephan	OFF	51	12-10-29 18:12						
34	G2	HI/LO FLOAT	OFF	14	12-10-29 18:07						
35	TH4	DC System Low Voltage	OFF	14	12-10-29 18:07						
36	TH5	Battery On Discharge	OFF	14	12-10-29 16:51						
37	PING2	Computer a Stephan Methot	ON	18	12-10-29 16:48						
38	PING2	Computer a Stephan Methot	OFF	17	12-10-29 16:31						
39	SUSER2	MULTITEL	OFF	16	12-10-29 16:16						
40	SUSER2	MULTITEL	ON	16	12-10-29 15:59						
41	USER2	stephan	ON	51	12-10-29 15:46						
42	PING1	Yves	OFF	20	12-10-29 15:40						

To reset the History log file, click on **System Information** from the top menu and then choose **Reset** on the left submenu. **Select History log file.**



IMPORTANT: This file can store up to 85,000 values in chronological order. When the file reaches 85,000 values the oldest values are lost as new ones are added. The first 4,800 values are stored in battery backup memory. Data will not be lost in the event of a power loss or a system reboot. Values older than 4,800 values will be lost if the device is depowered. When the unit is powered up the first transitions are logged in volatile memory only. This ensures that if the system resets many times valuable information about the events prior to shutdown can be obtained.

6.2.2 The system log file

The System Log file stores the last 200 security related system events. The status of each event is displayed in chronological order. Within the last 200 events the file records the last 50 login attempts into the system with user name, port source, access protocol and time. When the file reaches 200 events the oldest recording is lost and the new one is added. If the SYSLOG protocol is enabled, the values are automatically sent to the SYSLOG server as soon as they happen and they are also logged in the System log file.

For Security reasons the System Log file cannot be erased or reset by any user.

To download the **System Log file**, click on **File Transfer** from the top menu and then choose **Download** on the left submenu. Select **System Log (SYSLOG)** and open the file in Microsoft™ Excel.

System Log file in Excel

	A	B	C	D	E	F	G	H
1								
2	Multitel Inc.							
3	FUSION							
4	Software Version	4.50B06						
5	Unit	Energy Management DEMO						
6	10/30/2012 08:41:39							
7	FUSION V4.50B06							
8	System Log							
9								
10	Date	Time	User	Action	Source Port	Protocol		
11	12-10-30	8:34	multitel	Authenticated	207.253.73.68	HTTP		
12	12-10-30	7:46	stephan	Logged off	COMRS232	ASCII		
13	12-10-30	7:33	stephan	Authenticated	COMRS232	ASCII		
14	12-10-29	21:24	MULTITEL	Logged off	207.253.73.68	HTTP		
15	12-10-29	21:02	multitel	Authenticated	207.253.73.68	HTTP		
16	12-10-29	20:54	MULTITEL	Logged off	207.253.73.68	HTTP		
17	12-10-29	20:10	multitel	Authenticated	207.253.73.68	HTTP		
18	12-10-29	20:05	MULTITEL	Logged off	207.253.73.68	HTTP		
19	12-10-29		multitel	Authenticated	207.253.73.68	HTTP		
20	12-10-29		stephan	Logged off	COMRS232	ASCII		
21	12-10-29		stephan	Authenticated	COMRS232	ASCII		
22	12-10-29		stephan	Logged off	192.168.1.120	HTTP		
23	12-10-29	16:16	MULTITEL	Logged off	192.168.1.120	TELNET		
24	12-10-29	15:59	multitel	Authenticated	192.168.1.120	TELNET		
25	12-10-29	15:59	stephan	Logged off	192.168.1.120	TELNET		
26	12-10-29	15:50	stephan	Authenticated	192.168.1.120	TELNET		
27	12-10-29	15:46	stephan	Authenticated	192.168.1.120	HTTP		
28	12-10-29	15:29	MULTITEL	Logged off	207.253.73.68	HTTP		
29	12-10-29	15:01	stephan	Logged off	192.168.1.131	HTTP		
30	12-10-29	14:42	MULTITEL	Logged off	207.253.73.68	HTTP		
31	12-10-29	14:41	stephan	Authenticated	192.168.1.131	HTTP		
32	12-10-29	14:41	stephan	Wrong pass.	192.168.1.131	HTTP		
33	12-10-29	14:34	multitel	Authenticated	207.253.73.68	HTTP		
34	12-10-29	14:32	stephan	Logged off	192.168.1.241	HTTP		
35	12-10-29	14:31	stephan	Authenticated	192.168.1.241	HTTP		
36	12-10-29	14:30	B088	Wrong pass.	192.168.1.120	HTTP		
37	12-10-29	14:25	multitel	Authenticated	207.253.73.68	HTTP		
38	12-10-29	14:25		Device Startup				
39	12-10-29	14:23	stephan	Authenticated	192.168.1.120	HTTP		
40	12-10-29	14:20	stephan	Logged off	192.168.1.135	HTTP		
41	12-10-29	14:20	multitel	Authenticated	192.168.1.135	HTTP		
42	12-10-29	14:15	multitel	Authenticated	192.168.1.135	TELNET		
43	12-10-29	14:15	stephan	Logged off	192.168.1.135	TELNET		

44	12-10-29	14:04	stephan	Authenticated	192.168.1.135	TELNET		
45	12-10-29	14:03	stephan	Authenticated	192.168.1.135	HTTP		
46	12-10-29	14:03		Device Startup				
47	12-10-29	14:00	stephan	Authenticated	192.168.1.135	HTTP		
48	12-10-29	13:53	stephan	Logged off	192.168.1.131	HTTP		
49	12-10-29	13:52	stephan	Logged off	192.168.1.120	HTTP		
50	12-10-29	13:51	MULTITEL	Logged off	192.168.1.135	TELNET		
51	12-10-29	13:47	multitel	Authenticated	207.253.73.68	HTTP		
52	12-10-29	13:47	stephan	Authenticated	192.168.1.120	HTTP		
53	12-10-29	13:45	multitel	Authenticated	192.168.1.135	TELNET		
54	12-10-29	13:44	stephan	Authenticated	192.168.1.131	HTTP		
55	12-10-29	13:42		Device Startup				
56	12-10-29	13:30	stephan	Authenticated	192.168.1.120	HTTP		
57	12-10-29	13:27	stephan	Authenticated	192.168.1.131	HTTP		
58	12-10-29	13:25	stephan	Logged off	192.168.1.131	HTTP		
59	12-10-29	13:16	MULTITEL	Logged off	192.168.1.135	TELNET		
60	12-10-29	13:16	multitel	Authenticated	207.253.73.68	HTTP		
61	12-10-29	13:10	multitel	Authenticated	192.168.1.135	TELNET		
62	12-10-29	13:07	stephan	Authenticated	192.168.1.131	HTTP		
63	12-10-29	13:07	stephan	Logged off	192.168.1.135	HTTP		
64	12-10-29	11:11		Device Startup				
65	12-10-26	17:19		Device Startup				
66	12-10-26	17:10		Device Startup				
67	12-10-26	17:02		Device Startup				
68	12-10-26	16:56		Device Startup				
69	12-10-26	16:42		Device Startup				
70	12-10-26	16:38		Device Startup				
71	12-10-26	16:36		Device Startup				
72	12-10-26	16:33		Device Startup				
73	12-10-26	16:20		Device Startup				
74	12-10-26	15:39	stephan	Uploaded new configuration file				
75	12-10-26	15:21		Device Startup				
76	12-10-26	14:34		Device Startup				
77	12-10-26	12:01	stephan	Uploaded new configuration file				
78	12-10-26	8:26		Device Startup				
79	12-10-26	8:25	stephan	Uploaded new firmware file				
80	12-10-22	12:16	SUPERVISOR	Enabled user: ghislain				
81	12-10-22	12:16	SUPERVISOR	Added user: ghislain				
82	12-10-22	12:16	SUPERVISOR	Enabled user: stephanf				
83	12-10-22	12:16	SUPERVISOR	Added user: stephanf				

Part of the System Log file
showing system events
with date and time



IMPORTANT:

- Data is stored in non-volatile memory and will remain available if the device is depowered however, the memory is dependent on the on-board lithium 3.3Vdc battery.

6.3 CONFIGURATION FILE

The FUSION Configuration File contains all application specific configuration parameters necessary for the device to operate as defined by the user. It can be uploaded and downloaded using the **File Transfer** from the top menu. Uploading a configuration file does not overwrite the IP address already configured in the FUSION.

The configuration file can be downloaded from the FUSION for backup or to edit the file for a complete device update. In this case, when a configuration file is downloaded from the FUSION to a host computer, the name of the file is given the same name as the "Site name/location" configured in the "General System Parameter" function (this name appears in the HTTP(S) page header). If no "Site name/location" has been configured, the file name will be named "Config.CSV". This is true only for file download. During the upload of a configuration file to a FUSION unit, the name of the file is disregarded.

FUSION EEPROM memory stores application specific configuration parameters. The more times the memory is accessed the shorter the lifespan. FUSION is designed to allow dynamic changes during normal operation and as with all computer hardware there is a risk of data corruption during the read/write process that could cause a possible corruption of the parameter file. Multitel recommends that an up to date up-loadable backup copy of the configuration file be kept in the required CSV format. This will enable a user to upload and quickly restore the device to the most recent configuration if there is an issue.

6.4 IMAGE FILES (HMI VIEW)

FUSION's **HMI Views** files are user defined. They can represent a graphical view of FUSION's specific application or any other site application. The files are selected with the HMI views menu. These images contain telemetry information like analog values with units, binary statuses, On/Off buttons etc. More than one image file can be loaded into FUSION using the File Transfer from the top menu and Upload from the left submenu up to a maximum of 1 Megabyte. The number of files that can be uploaded to the FUSION depends upon the complexity of the images themselves.

Downloading the HMI Views files to a host computer is done with the "File Transfer" from the top menu and Download from the left sub-menu.

Two parameters must be configured in the **General System Parameters** to enable a HMI view file to become the FUSION's home page (Refer to section 4.3 GENERAL SYSTEM PARAMETERS). If the function is not enabled, the FUSION's home page will be the default to the **All Active Alarms** page.

To display an uploaded HMI view image, click on the **HMI Views** from the top menu and select one of the image file on the left submenu. Images on the HMI views are available even if the home page function is disabled.

Image file format is .XMG and contain multiple telemetry points. These files are custom designed according to your requirements and can be created by Multitel's experienced technicians. Contact Customer service for more information **Tel:** (888) 685-8483 (US & Canada) and (418) 847-2255 (International).

6.5 NOTE FILE

The NOTE File is provided for engineering and field staff to add special notes, inventory information or site specifics into an easily accessible file. The information written in this file is transferred to the FUSION unit only through the upload of a file in CSV format.

To upload the NOTE File, click on **File Transfer** from the top menu and then choose **Upload** on the left submenu. Select **NOTE File** and then browse to upload the selected .CSV file to the unit.

Once the NOTE File is uploaded into the FUSION device it can be viewed under the **System Information** from the top menu and the **NOTE File** on the left submenu.

Example of a NOTE File:

The screenshot displays the FUSION web interface. At the top, there is a navigation bar with the 'FUSION' logo and a 'Logout' link. Below this is a secondary navigation bar with links: 'Alarms | Views | I/O Channels | Derived Channels | File Transfer | System Information | Links | Config | HMI Views | Charts'. The main header area shows 'TEMPLATE 1 HVAC R-410' and status indicators for 'CRI', 'MAJ', 'MIN', and 'INF'. On the left, a 'Menu' sidebar lists various system components, with 'Note File' selected at the bottom. The main content area, titled 'Note File', displays the text of the uploaded file, which is a document about the TL1 protocol. The text describes TL1 as a widely used management protocol in telecommunications networks, mentions its low profile and vendor-independent nature, and discusses requirements for a management interface, improvements, and the need for better tools and support for TL1 devices.

On the CLI use the command "**note**" to display the contents of the NOTE file.

6.6 EXPORTATION TO MICROSOFT EXCEL

As discussed in previous sections (4.1 and 4.2) statistical and historical files can be exported to Excel. Please find additional information to assist with the exportation process.

When a file is selected for download the user is asked to Open or Save the file or Cancel the activity.



Files downloaded from FUSION are CSV format and are compatible with most commercially available spreadsheets on the market such as Microsoft™ Excel.

If each parameter does not appear in a different cell the file will need to be closed and the “list separator” parameter in Windows Control Pane Regional Settings will need to be adjusted. Please also note that the column widths in Excel may need to be adjusted.

7 AUTOMATION FUNCTIONS

FUSION provides numerous automation functions such as: pre-programmed algorithms, time set points, programmable delays, etc. Each automation function may be customized for better adaptation to required field application needs. This section covers each function with examples.

7.1 LOGICAL EQUATIONS

To form a Logical equation the following operands must be used between triggering sources. FUSION will validate the programmed equation and may request the user to enter it again if the equation is not valid or not properly programmed. In exceptional cases if the equation is too complex and too long to execute, FUSION will also request the user to enter it again.

Table 40 - Operands for logical equations

Operand	Description	Usage
" + "	"OR" operand	Anyone or both triggering sources must be active to be valid.
" * "	"AND" operand	Both triggering sources must be active to be valid.
" "	"NOR" operand	When placed in front of a triggering source, the logic is reversed.
"(" and ")"	Parentheses	The equation in parentheses will be resolved first.

NB: There are no spaces between the variables and the operands.

7.1.1 Examples of logical equations

The equation $F1E1+(TH1*TH3)+!BM1$ is valid and is solved as $F1E1 \text{ OR } (TH1 \text{ AND } TH3) \text{ OR NOT } BM1$. The parentheses are important as they prioritise the $TH1 \text{ AND } TH3$ operation before resolving the OR operation. If the parentheses are omitted $F1E1 \text{ OR } TH1$ will be solved first and the result will be compared with $TH3$ for the AND operator.

(See [section 7.2](#) Group application example for an additional example)

7.1.2 The "ON" binary channel

An "ON" binary channel (logical 1) is available for general use in logical equations, as trigger source or to be used as an output. This binary channel cannot be seen on the HTTP(S) interface. In Command Line Interface (CLI), when typing "?" the ON binary channel will be shown on screen under "list of active alarms OTHERS".

This channel is useful to keep a specific function permanently activated like for examples: detailed statistics, AWH[x] channels or a LED[x] channel. The ON signal can also be used to keep an output signal to a logical 1 acting as a failsafe function. FUSION already has a failsafe relay; another one can be useful for electrical isolation purpose.

7.2 GROUPS (200)

FUSION can generate hundreds of alarms. A special function is designed to “Group” together similar types of alarms (environmental, power etc.). The group function can also assist in building a specific complex controlling algorithm. Groups enable user to create logic equations consisting of one or many sources up to a maximum of 25. These channels are displayed on the HTTP(S) interface under the **Derived channels** top menu.

Each **G[x]** channel is individually programmed. Click on **Config** from the top menu (Supervisor access only) and then choose **Groups** on the left submenu. Select the **G[x]** to be configured.

Table 41 - G[x] Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Triggering equation	Each triggering source can be preceded by the negation operator (!). Parenthesis “(” and “)” may be used with a maximum of 12 pairs as well as Operators “+”(logical OR) and “*” (logical AND). Maximum of 225 characters or 25 sources. Refer to Table 31 and Table 32 (Binary Fail signals) for the lists of available triggering sources.	
Alarm Level	Each Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info
Operating method	Groups may be latched. In this mode of operation the channel will stay ON after a TRUE condition until: <ol style="list-style-type: none"> 1. A transition to ON occurs on the triggering source specified as the unlatching condition 2. An authorized USER manually unlatches the group using the “RESET” command via the Command line Interface. Select: Not Latched or Latched	Not Latched
Trigger for resetting occurrence counter	The occurrence counter can be reset to 0 by providing a triggering source. Refer to section 3.13 for the list of possible triggering sources.	Not Programmed
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	

7.2.1 Group application example

In this example different Building Door Access Alarms are grouped to build an Intrusion Alarm Group names G2.

The following signals are used:

F1E1: Door open Warehouse

F1E2: Door open Front

F1E13: Warehouse entrance keypad activation signal (active until door closed)

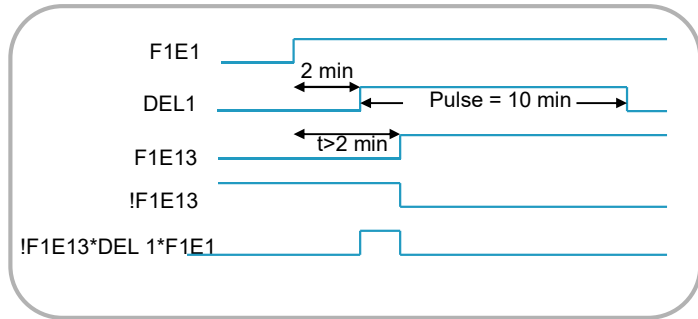
Del1: Delay, Warehouse door open alarm delay to give time to reach the keypad after opening the door. The delay is able to retrigger, the activation delay is set to 120 seconds, the delay duration is 10 minutes and the triggering source is F1E1.

TSP1: The signal is set to be ACTIVE every day from 17:00h to 07:00 the next morning.

The triggering equation for G2: ((IF1E13*DEL1*F1E1)+F1E2)*TSP1

Logical equation: ((NOT F1E13 AND DEL1 AND F1E1) OR F1E2) AND TSP1

Therefore from 5 PM to 7 AM, if someone opens the front door or the warehouse door without entering the right code into the warehouse keypad within the allowed 2 minutes an alarm will be activated.



7.3 PROGRAMMABLE DELAYS AND PROGRAMMABLE DELAY VALUES (128)

FUSION can manage up to 128 programmable delays and delay values.

7.3.1 Programmable delays

A delay is a triggering source activated by another triggering source and configured with a pre-set activation delay and a delay duration timer. A delay can be used as a temporal damper (delay), latched to extend the ON state of a trigger or to postpone some other trigger activation. Another triggering source may be programmed to stop the activation delay countdown for easier automation. These channels are displayed on the HTTP(S) interface under the **Derived channels** menu.

Each delay channel is individually programmable. Click on **Config** on the top menu (Supervisor access only) and then choose **Programmable Delay** on the left submenu. Click on the **DEL[x]** to be configured.

Table 42 - DEL[x] Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info
Operation mode	Three modes of operation are possible: not retriggerable, retriggerable or Keepalive. In the 'retriggerable' mode, the timer will be reset if the triggering source goes through an additional OFF to ON transition before the original delay has had time to expire. In the normal mode, 'not retriggerable', additional transitions that may occur before the original delay has had time to expire will not cause the timer to be reset. In the Keepalive mode, the DEL(x) will start to countdown at the Keepalive delay duration value and will revert back whenever the Keepalive reset condition is met. Some examples are shown below the table.	Retriggerable

Parameters	Description	Default Value
Activation delay	Pre-set time used to postpone a triggering source. The delay is turned ON when its triggering source becomes valid and is delayed by the time configured as the activation delay. If the trigger source goes to the OFF state before the expiration of the activation delay, the DEL[x] will not be activated. Select: 1 to 6000000 seconds. The delays can be configured in seconds, minutes or hours using the following format: be XXhXXmXXs or XXXXXXX seconds.	1 second
Delay duration	Pre-set time used to set the duration of the DEL[x] function. The function does not depend on <u>the period of time during which the triggering source stays ON</u> . The delays can be configured in seconds, minutes or hours using the following format: be XXhXXmXXs or XXXXXXX seconds. Select: 1 to 6 000 000 seconds.	
Triggering source	Enter the delay triggering source. Refer to Table 31 and Table 32 (Binary Fail signals) for the lists of available triggering sources.	
Stopping countdown	Enter the triggering source used to stop the countdown related to the delay duration time. Refer to Table 31 and Table 32 (Binary Fail signals) for the lists of available triggering sources.	
Keepalive delay reset source	Enter the triggering source used to re-initialised delay back to its delay duration time.	None
Enter keep alive delay duration	The delays can be configured in seconds, minutes or hours using the following format: be XXhXXmXXs or XXXXXXX seconds. Select: 1 to 6 000 000 seconds.	60 seconds
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	

7.3.2 Keepalive

Programmable delay can also be used to trigger a Callout on a periodic basis in order to validate the communication link between the FUSION and the final destination server. If ever the Keepalive is not is

To generate a periodic "Keepalive callout", configure a programmable delay **DEL[x]** as follow:

- Name = Site Name Keepalive trigger
- Operation Mode: select "Keepalive"
- Keepalive delay reset source: Use the COUT[x] to re-initialised the countdown delay.
- Keepalive delay duration: Specify at which interval the Keepalive should be triggered.

For more information on Callout, go to [section 7.1](#) of this manual

7.3.3 Programmable delay values

These channels are associated with the programmable delay channels. They are used to display the delay duration's remaining time in seconds. They automatically inherit their associated programmable delay channel's configuration therefore these channels are not configurable.

Following are views of one DELV derived channel associated to its programmable delay channel DEL.

The top screenshot shows the 'Programmable Delay' configuration screen for 'TEMPLATE 1 HVAC R-410'. The 'DEL1' channel is selected, and its properties are listed:

Property	Value
The channel state is	Enabled
The name is	HVAC 1 MANUAL BLOWER TURN OFF DELAY
The alarm level is	Not Logged
The operation mode is	retriggerable
The activation delay is	0 seconds
The delay's duration is	30 seconds
The triggering source is	IBM2
The channel for stopping countdown is	6

The bottom screenshot shows the 'Programmable Delay Value' table for the same template:

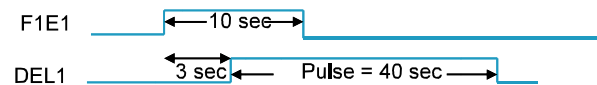
Mnemonic	Channel Name	Value
DEL1	HVAC 1 COMPRESSOR 180S RESTART DELAY	0 Sec
DEL2	HVAC 1 COMPRESSOR 600S MIN OP TIME	0 Sec
DEL3	COMFORT BUTTON 20-25°C 1 HOUR PERIOD	NA Sec
DEL7	HVAC 1 MANUAL BLOWER TURN OFF DELAY	18 Sec

In this example, we see that 18 seconds are left from the original 30 seconds programmed in the delay.

7.3.4 Delay application examples

Simple delay example:

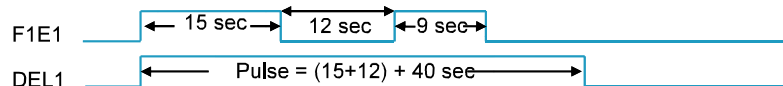
Suppose that DEL1 (mnemonic for Delay1) is enabled. The activation delay is used to simply delay the triggering source by a pre-set time (3 seconds in this example). The delay duration is set to 40 seconds. This is useful for noise filtering applications.

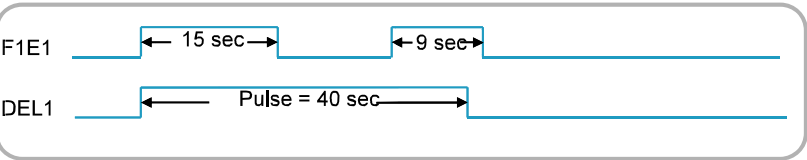


Retriggerable and not-retriggerable examples:

Suppose that DEL1 is enabled, the delay duration is set to 40 seconds, the activation delay is set to 0 seconds, the triggering source is F1E1.

The first example displays the retriggerable option.

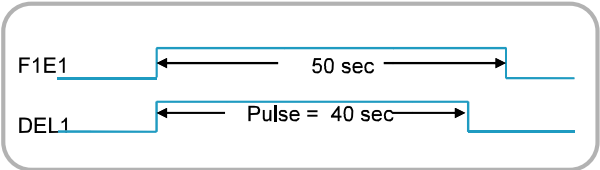
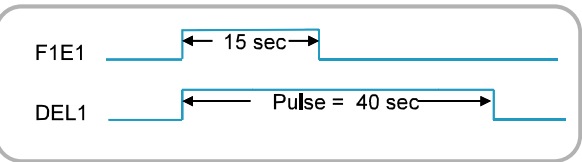




The second example displays the not-retriggerable option.

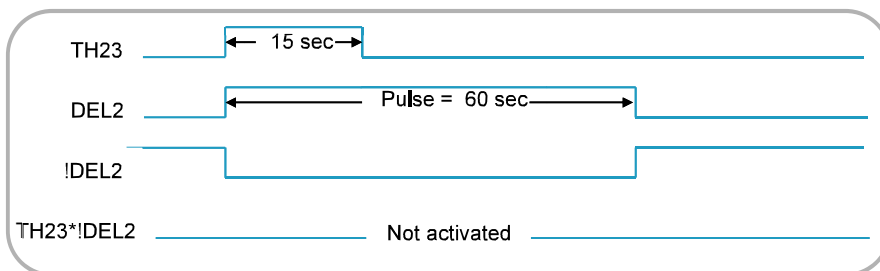
Latching examples (not retriggerable):

This is used to get a signal of fixed pulse duration independently of the length of the triggering signal (very useful to extend a very short triggering signal). Suppose that DEL1 is enabled, the delay duration is 40 seconds and the triggering source is F1E1. The activation delay is 0. In this case, DEL1 will turn ON at the same time as F1E1. It will stay ON for 40 seconds, no matter how long F1E1 stays ON.

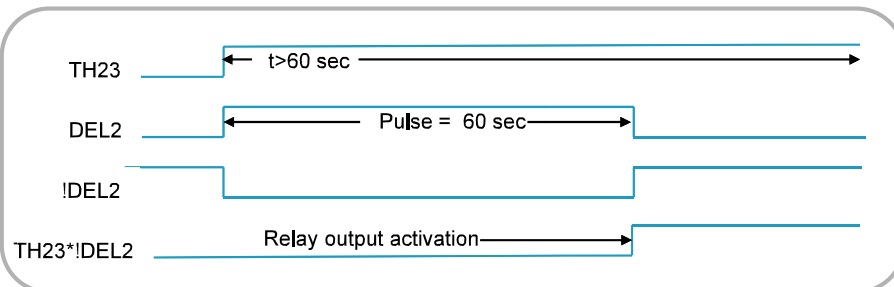


Relay output activation:

Suppose that DEL2 is enabled, its duration is 60 seconds and its triggering source is TH23 (mnemonic for threshold #23). The activation delay is set to 0. Suppose also that Relay output 3 of card 5 is activated by the $TH23*!DEL2$ equation.



To turn "ON" the relay output #3 of card #5, TH23 must be ON while DEL2 is OFF. Therefore, if TH23 does not stay ON for at least 60 seconds, relay output #3 of card #5 will not turn ON.



7.4 TIME SET POINTS (TSP) (64)

FUSION offers 64 Time Set Points, TSP[x]. A TSP is a cyclic trigger source activated by the system clock. The TSP stays ON as long as the user-programmable temporal coordinate matches the system clock. TSPs can be used in conjunction with an output relay to periodically start a device, perform a callout, or as a maintenance reminder. These channels are displayed on the HTTP(S) interface under the **Derived channels** top menu.

Each Time Set Points channel is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Time Set Points** on the left submenu. Click on the **TSP[x]** to be configured.

Table 43 - TSP[x] Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Coordinates for time set points	Format for TSP coordinates: The first format (normal mode) contains 4 fields and the second (fixed interval cycle), 6 fields. In both cases, each field is optional but at least one must be specified. An empty field is considered as always matching the corresponding clock field. The values in the fields must be contiguous and valid. It is recommended to specify more than one field. Each field is optional but all separators must be present, including the comma. E.g. Friday,11:: Will become active every Friday at 11:00:00. Friday,:30: Will become active on Fridays at the 30th minute of every hour. //,:12 Will become active every minute at the 12th second.	//,::

Parameters	Description	Default Value
TSP Duration	Duration the TSP must remain active. Select: 1 to 6000000 seconds The duration can be configured in seconds, minutes or hours using the following format: be XXhXXmXXs or XXXXXXX seconds.	1 second
Mode of operation	There are two modes of operation. The first is based on the day of the week (normal mode); the second is based on a precise date (fixed interval cycle). If the operating mode is 'fixed interval cycle', the TSP will become active at regular intervals after the first scheduled activation. Select: Normal or fixed interval cycle.	Normal
Alarm Level	Each Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	

7.4.1 TSP application examples

Correct application:

Monday,23:00:00 is ON 1 second every Monday from 23:00:00
 2008//, is ON during year 2008
 //,:5 is ON at the 5th second of every minute
 Thursday, is ON every Thursday
 //,:9: is ON every 9 minutes after the hour

Incorrect application:

Mon,23:00:00 Day of week is not complete
 //29,00:00:00 29th day of month is not valid every month/every year

7.5 BINARY MANUALS (128)

Binary manuals are binary channels for which states can be controlled by the user. Binary manuals can have the following states: ON, OFF, Disabled. They may also be used as triggering sources. These channels are displayed on the HTTP(S) interface under the **Derived channels** top menu. To control a Binary Manual, click the On/Off button (if the USER has the right access level). Following is a View with two Binary manuals.



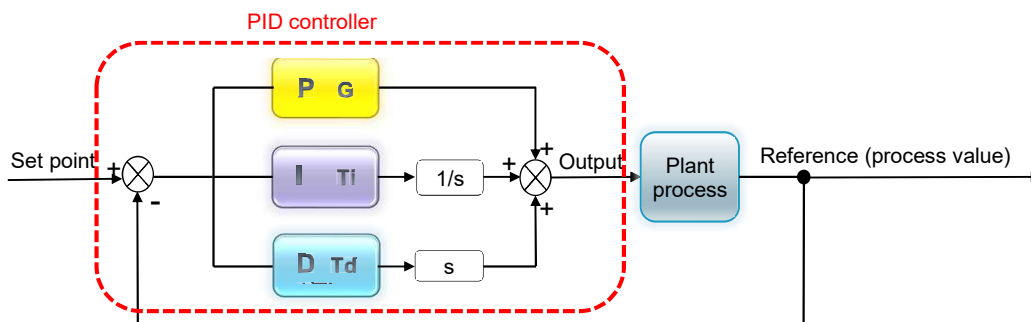
Each Binary manual channel is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Binary Manual** on the left submenu. Click on one of the 128 **BM[x]** to be configured.

Table 44 - BM[x] Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
User level for activation	Access to a binary manual can be limited to a specific access level. Select: viewer, user or supervisor	supervisor
Alarm Level	Each Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info
Activation duration	The Binary manual uses two (2) operating modes. Either the manual mode can be used requesting the user to enable and disable the Binary manual or the time delay mode can be chosen where the user can set a time value between 0 and 999 seconds. If the time delay mode is used the user must enable the Binary Manual and this one is going to disable itself when the programmed delay has elapsed. However, if the user wants to disable the Binary Manual before the end of the programmed delay, he can do so by clicking on the Off button of the concerned BM function under the Derived Channels top menu, Binary Manual left submenu (if the user has the right permission to do so). Select: 0 to 999 seconds where 0 = manual.	manual
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	

7.6 PID CONTROLLERS (8)

A PID controller (Proportional, Integral and Derivative) is a closed loop auto regulation system that attempts to minimize the value as the difference between a measured process variable and a desired set point. The PID controller has become the most used controller in the industry for its capacity to control a wide range of physical processes.



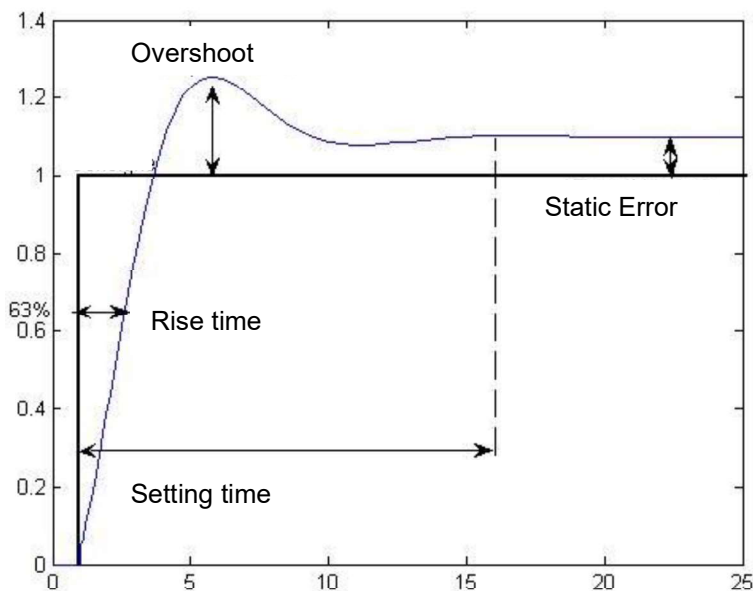
The PID controller work 3 different ways, it is the summation of:

- Proportional action: The error is multiplied by a gain G. This part determines the reaction to the actual error.
- Integral action: The error is integrated and divided by a gain Ti. This part determines the reaction based on the sum of recent errors.

- Derivative action: The error is derived and multiplied by a gain T_d . This part determines the reaction based on the rate at which the error has been changing.

This type of controller is used in the industry to regulate temperature, pressure, flow rate, speed and practically every variable for which a measurement exist. It is possible to use only the P, PI, and PD part of the PID; for this, the unused gain needs to be set to zero. The PI is very common since the derivative action is very sensitive to measurement noise.

Figure 7 - Stable process typical response



Wikipedia The Free Encyclopedia: http://wikipedia.org/wiki/PID_controller

FUSION provides 8 PID functions. Each PID function is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **PID** on the left submenu. Click on one of the 8 **PID[x]** to be configured. Once configured, the PIDs are displayed under the **Derived channels** menu.

Table 45 - PID[x] Configuration parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Number of decimal digits	Value representation: Choice Between 0 and 4 digits where 4=auto	4
Reference channel (Process Value)	Channel representing the measured value for the process to be regulated.	Not Programmed
Set point channel (set point)	Channel representing the set point value. E.g., a Constant channel can be used to represent the set point value.	Not Programmed
Proportional gain	The higher the proportional gain is, the faster is the rising time but the overshoot is also greater. Select: $-3.40282e^{38}$ to $3.40282e^{38}$. Deactivated when =0	1
Integral gain	The higher the proportional gain is the slower is the system. However, it enables elimination of the static error but it also increase system instability. Select: $-3.40282e^{38}$ to $3.40282e^{38}$. Deactivated when =0	0

Parameters	Description	Default Value
Derivative gain	The derivative gain increase system stability, reduce overshoot and improve transient response. It is however very sensitive to measurement noise. Select: $-3.40282e^{38}$ to $3.40282e^{38}$. Deactivated when =0	0
Reference channel stabilisation delay	Delay, in seconds, for the stabilisation of the reference (process) signal. It is activated after a FUSION start-up or after a change in the reference channel parameter. Select: 0 to 600 seconds.	10s
Maximum output value	Upper limit value allowed for the PID output signal. Select: $-3.40282e^{38}$ to $3.40282e^{38}$.	$3.40282e^{38}$
Minimum output value	Lower limit value allowed for the PID output signal. Select: $-3.40282e^{38}$ to $3.40282e^{38}$.	$3.40282e^{38}$
Zero output value (dead spot value)	Neutral output value for the PID. E.g., if the output range is between 0 and 10 V. The zero output value can be set to midrange, 5V, and the PID will regulate around this value. Select: $-3.40282e^{38}$ et $3.40282e^{38}$.	$3.40282e^{38}$
Integrator maximum value	Upper limit value allowed for the Integration part of the error. Select: $-3.40282e^{38}$ to $3.40282e^{38}$.	$3.40282e^{38}$
Integrator minimum value	Lower limit value allowed for the Integration part of the error. Select: $-3.40282e^{38}$ to $3.40282e^{38}$.	$-3.40282e^{38}$

A Binary Fail signal **BFPID[x]** will be triggered in case of a problem with a PID channel. Two different statuses for the PID channel can be displayed. The ERR status will indicate a wrong configuration of the PID. The conditions for triggering a fail signal related with the ERR status are:

- The Reference channel (process value) has not been configured.
- The Set point channel has not been configured or its configured channel has not been setup (e.g., if CONST1 is configured in the PID parameters but CONST1 does not exist).
- If the maximum output or minimum output parameter values are let to their default values.
- If the zero output value is let to its default value.

The NA status (Not Available) will be displayed during the stabilisation delay pre-set time for the Reference Channel (process value). All of those conditions will trigger a **BFPID[x]** signal for a PID function that is enabled or also disabled.

There are various PID tuning methods; one of the simplest is the successive approaches method:

1. Adjust the proportional gain to get a 10 to 15% overshoot.
2. Adjust the derivative gain to flatten the overshoot.
3. Adjust the integral gain (if necessary) by setting a final overshoot between 5 and 10%.

7.6.1 Application example of a PID

E.g., we have setup a PID2 for to control the Room ambient temperature. To regulate the temperature, we use a PI therefore derivative gain is set to zero. The temperature Set point is configured in the CONST3 channel and set to 24°C. The selected reference channel (process value) is M1A1, the room ambient temperature. The output of the regulator will act on a switch to turn the heater on and off.

The screenshots show the FUSION Trial web interface with the following configurations:

PID2 Configuration

Property	Value
The channel state is	Enable
The name is	Room ambient temperature
The number of decimal digits is (4 = auto)	4
The reference channel (PROCESS VALUE) is	M1A1
The setpoint channel (SETPOINT) is	CONST3
The proportional gain is	0.7
The integral gain is	1
The derivative gain is	0
The reference channel stabilization delay (S) is	10
The maximum output value is	8
The minimum output value is	2
The zero output value (dead spot value) is	5
The integrator maximum value is	3
The integrator minimum value is	3

Constant (CONST3) Configuration

Property	Value
The channel state is	Enable
The name is	Temperature setpoint
The measure unit is	°C
The number of decimal digits is (4 = auto)	4
The constant value is	24.00

Module (M1A1) Configuration

Property	Value
The channel state is	Enable
The name is	Room Temperature
The measure unit is	°C
The number of decimal digits is (4 = auto)	2
The register address is	101
The reading function code is	3
The data type is	16 Bit Integer
The sign is	Signed Integer
The multiplication factor is	0.1

8 SOFTWARE FUNCTIONS

8.1 CALLOUTS (32)

FUSION provides 32 programmable channels for callouts and each callout can be configured with a name. A list of up to 50 triggering sources or alarm levels can be sent to the selected output port (RS-232/USB front or RS-232, RS485 rear panel, Ethernet or Modem port(if available)). Triggering sources and alarm levels can be configured to generate a callout. Each channel is displayed on the HTTP(S) interface under the **Derived channels** menu. When triggering a callout by alarm level, it is possible to filter out up to 50 unwanted specific "triggering sources".

Each Callout function is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Callout** on the left submenu. Then select one of the 32 **COUT[x]** channels. A list of programmable parameters will be displayed.

The configuration parameters differ depending on the chosen protocol or triggering mode.

The next sections will describe each COUT[x] configuration parameter depending on the selected protocol.

Refer to Table 31 and Table 32 (Binary Fail signals) to view the complete list of available triggering sources.

Four (4) types of protocols are available for each of the thirty two (32) Callouts.

8.1.1 Multitel protocol

This protocol is reserved for the exclusive use of Multitel's alarm management software.

Table 46 - COUT[x] Configuration Parameters for Multitel protocol

Parameters	Description	Default Value
Callout state	Disabled or Enabled.	Disabled
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info
Protocol	Protocol chosen to send the callout. Select: Multitel , Trap SNMP, e-Mail or ASCII/TL1	Multitel
Triggering mode	Triggering mode for the Callout. Select: Trigger list or Alarm level	Trigger list
Triggering source	This parameter will display on the screen only if the Trigger list option has been selected (parameter above). Sources with alarm level "Not logged" will not trigger a callout. Up to 50 triggering sources may be selected.	
Priority level	This parameter will show on the screen only if the Alarm level option has been selected (parameter Triggering mode). Select: Critical, Major and Critical, Minor to critical or Info to critical.	Critical
Transition	The callout will be triggered on which transition. Select: OFF to ON, ON to OFF or ALL transitions.	OFF to ON

Parameters	Description	Default Value
Output port	Output port selection for the callout : 0 – RS-232/USB Frontal port (Craft Port) 1 – RS-232 Rear port 2 - Internal MODEM (Not installed) Warning! The internal modem is not installed if a callout is using this port it will be automatically disable. 3 - RS485 Rear port 4 - ETHERNET port	RS-232/USB Frontal port (Craft Port)
Phone number	Phone number used for the Callout via a modem. This parameter will show on the screen only if the port selected (parameter above) is not the Ethernet port.	
IP address	IP address or domain name for the Callout destination. IP address format: NNN.NNN.NNN.NNN This parameter will show on the screen only if the port selected is the Ethernet port.	0.0.0.0
TCP port number	The port TCP number is like a channel used to make the connection with remote IP devices. Together with the computer IP address it completes the destination address for a communication session. This parameter will show on the screen only if the port selected is the Ethernet port.	2000
Repetition number	Number of call to be repeated. Select: 0 to 9	3
Repeating Delay	Time between each tries. Select: 2 to 480 minutes	10 minutes
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	0

8.1.2 Trap SNMP protocol

An SNMP Trap will be sent to up to five (5) SNMP Managers when this protocol is enabled. It can also carry an intelligent ASCII/limited TL1 message (see section 8.1.6 for details). The IP addresses, domain names and Community names of the destination Managers can be configured in the **SNMP Protocol** submenu. This callout type can be send through the Ethernet port only.

NOTE: FUSION is limited to sending SNMPv3 traps to only one SNMP Manager, thus security parameter configured in the destination #1 to destination #5 of “SNMP protocol” section will not be used.

Table 47 - COUT[x] Configuration Parameters for TRAP SNMP protocol

Parameters	Description	Default Value
Callout state	Callout Status: Disabled or Enabled.	Disabled
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info
Protocol	Protocol chosen to send the callout. Select: Multitel, Trap SNMP , eMail or ASCII/TL1	Multitel
Message	Message to be sent. Maximum of 255 characters	
Triggering mode	Triggering mode for the Callout. Select: Trigger list or Alarm level	
Triggering source	This parameter will show on the screen only if the Trigger list option has been selected (parameter above). Sources with alarm level Not logged will not trigger a callout. Up to 50 triggering sources may be selected.	

Parameters	Description	Default Value
Priority level	This parameter will show on the screen only if the Alarm level option has been selected (parameter Triggering mode). Select: Critical, Major and Critical, Minor to critical or Info to critical.	Critical
Transition	The callout will be triggered on which transition. Select: OFF to ON, ON to OFF or ALL transitions.	OFF to ON
Destination manager list	Up to five SNMP managers can be configured for the SNMP protocol. The SNMP managers' IP addresses or domain names are entered when configuring the SNMP protocol (refer to section 10.5.9 for details). Here, it is possible to choose a list of available SNMP managers for the callout configuration. Select: 1 to 6 where 6 correspond to all managers. Multiple selections are allowed, for example if you entered 1+2, managers 1 and 2 will be selected.	Not programmed
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	0

8.1.3 Email protocol

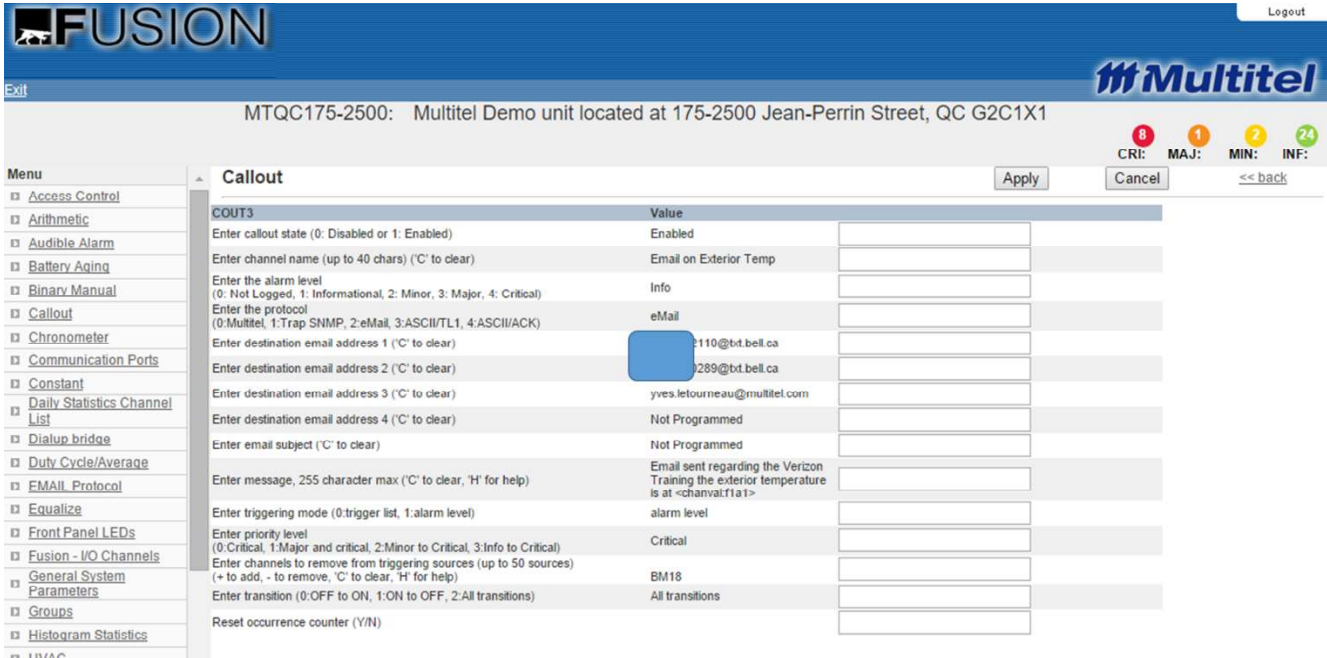
An Email will be sent to up to four (4) Email addresses destinations when this protocol is chosen. It can also carry an intelligent ASCII/limitedTL1 message. The IP addresses or domain names of the SMTP server can be configured using the **EMAIL protocol** submenu. This callout type can be sent through the Ethernet port only.

Table 48 - COUT[x] Configuration Parameters for email protocol

Parameters	Description	Default Value
Callout state	Callout Status: Disabled or Enabled.	Disabled
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info
Protocol	Protocol chosen to send the callout. Select: Multitel, Trap SNMP, eMail or ASCII/TL1	Multitel
Destination email address 1	Address or domain name receiving the Callout.	Not Programmed
Destination email address 2	Address or domain name receiving the Callout.	Not Programmed
Destination email address 3	Address or domain name receiving the Callout.	Not Programmed
Destination email address 4	Address or domain name receiving the Callout.	Not Programmed
Email subject	Subject concerning the callout. (Title of the message)	Not Programmed
Message	Enter the Callout message. Maximum of 255 characters.	
Triggering mode	Triggering mode for the Callout. Select: Trigger list or Alarm level	Trigger list
Triggering source	This parameter will show on the screen only if the Trigger list option has been selected (parameter above). Sources with alarm level Not logged will not trigger a callout. Up to 50 triggering sources may be selected.	
Priority level	This parameter will show on the screen only if the Alarm level option has been selected (parameter Triggering mode). Select: Critical, Major and Critical, Minor to critical or Info to critical.	Critical

Parameters	Description	Default Value
Transition	The callout will be triggered on which transition. Select: OFF to ON, ON to OFF or ALL transitions.	OFF to ON
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	0

Example of SMTP (Email) Callout triggered by “Critical” alarm level and mnemonic BM18 has been filtered out



Exit MTQC175-2500: Multitel Demo unit located at 175-2500 Jean-Perrin Street, QC G2C1X1 Logout

8 CRI: 1 MAJ: 2 MIN: 24 INF:

Menu

- Access Control
- Arithmetic
- Audible Alarm
- Battery Aging
- Binary Manual
- Callout
- Chronometer
- Communication Ports
- Constant
- Daily Statistics Channel List
- Dialup bridge
- Duty Cycle/Average
- EMAIL Protocol
- Equalize
- Front Panel LEDs
- Fusion - I/O Channels
- General System Parameters
- Groups
- Histogram Statistics

Callout Apply Cancel << back

COU3	Value
Enter callout state (0: Disabled or 1: Enabled)	Enabled
Enter channel name (up to 40 chars) ('C' to clear)	Email on Exterior Temp
Enter the alarm level (0: Not Logged, 1: Informational, 2: Minor, 3: Major, 4: Critical)	Info
Enter the protocol (0: Multitel, 1: Trap SNMP, 2: eMail, 3: ASCII/TL1, 4: ASCII/ACK)	eMail
Enter destination email address 1 ('C' to clear)	110@bt.bell.ca
Enter destination email address 2 ('C' to clear)	289@bt.bell.ca
Enter destination email address 3 ('C' to clear)	yves.letourneau@multitel.com
Enter destination email address 4 ('C' to clear)	Not Programmed
Enter email subject ('C' to clear)	Not Programmed
Enter message, 255 character max ('C' to clear, 'H' for help)	Email sent regarding the Verizon Training the exterior temperature is at <chanval1a1>
Enter triggering mode (0: trigger list, 1: alarm level)	alarm level
Enter priority level (0: Critical, 1: Major and critical, 2: Minor to Critical, 3: Info to Critical)	Critical
Enter channels to remove from triggering sources (up to 50 sources) (+ to add, - to remove, 'C' to clear, 'H' for help)	BM18
Enter transition (0: OFF to ON, 1: ON to OFF, 2: All transitions)	All transitions
Reset occurrence counter (Y/N)	

8.1.4 ASCII/TL1 protocol

A raw Callout text with intelligent ASCII/limitedTL1 message (see section 7.1.6 for details) will be sent when this protocol is chosen.

Table 49 - COUT[x] Configuration Parameters for ASCII/ TL1 protocol

Parameters	Description	Default Value
Callout state	Callout Status: Disabled or Enabled.	Disabled
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info
Protocol	Protocol chosen to send the callout. Select: Multitel, Trap SNMP, eMail or ASCII/TL1	Multitel
Message	Enter the Callout message. The message can include an intelligent message text (see 7.1.5) Maximum of 255 characters.	
Triggering mode	Triggering mode for the Callout. Select: Trigger list or Alarm level	Trigger list
Triggering source	This parameter will show on the screen only if the Trigger list option has been selected (parameter above). Sources with alarm level Not logged will not trigger a callout. Up to 50 triggering sources may be selected.	
Priority level	This parameter will show on the screen only if the Alarm level option has been selected (parameter Triggering mode). Select: Critical, Major and Critical, Minor to critical or Info to critical.	Critical
Transition	The callout will be triggered on which transition. Select: OFF to ON, ON to OFF or ALL transitions.	OFF to ON
Output port	Output Port selection for the callout : 0 – RS-232/USB Frontal port (Craft Port) 1 – RS-232 Rear port 2 - Internal MODEM (Not installed) Warning! If an internal modem is not installed this port it will be automatically disabled. 3 - RS485 Rear port 4 - ETHERNET port	RS-232/USB Frontal port (Craft Port)
Phone number	Phone number used for the Callout using a modem. This parameter will show on the screen only if the Output port selected (parameter above) is not the Ethernet port.	
IP address	IP address or domain name for the Callout destination. IP address format: NNN.NNN.NNN.NNN This parameter will display only if the port selected is the Ethernet port.	0.0.0.0
TCP port number	The port TCP number is like a channel used to make the connection with remote IP devices. Together with the computer IP address it completes the destination address for a communication session. This parameter will display on the screen only if the port selected is the Ethernet port.	2000
Repetition number	Number times call is to be repeated. Select: 0 to 9	3
Repeating Delay	Time between each re-try. Select: 2 to 480 minutes	10 minutes
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	0

8.1.5 ASCII/ACK protocol

This Callout protocol is available for the Dialup bridge specific function. The purpose is to exchange reliably alarm information between two FUSIONs. The protocol is raw text with a proprietary form of acknowledgment when data is exchange between a Distant FUSION and a Host FUSION. It is only used with the Dialup bridge feature described in [section 7.2](#) of this document.

Table 50 - COUT[x] Configuration Parameters for ASCII/ ACK protocol

Parameters	Description	Default Value
Callout state	Callout Status: Disabled or Enabled.	Disabled
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info
Protocol	Protocol chosen to send the callout. Select: Multitel, Trap SNMP, eMail, ASCII/TL1 or ASCII/ACK	Multitel
Message	Enter the Callout message. The message can include an intelligent message text (see 7.1.5) Maximum of 255 characters.	
Triggering mode	Triggering mode for the Callout. Select: Trigger list or Alarm level	Trigger list
Triggering source	This parameter will show on the screen only if the Trigger list option has been selected (parameter above). Sources with alarm level Not logged will not trigger a callout. Up to 50 triggering sources may be selected.	
Priority level	This parameter will show on the screen only if the Alarm level option has been selected (parameter Triggering mode). Select: Critical, Major and Critical, Minor to critical or Info to critical.	Critical
Transition	The callout will be triggered on which transition. Select: OFF to ON, ON to OFF or ALL transitions.	OFF to ON
Output port	Output Port selection for the callout : 0 – RS-232/USB Frontal port (Craft Port) 1 – RS-232 Rear port 2 - Internal MODEM (Not installed) Warning! If an internal modem is not installed this port it will be automatically disabled. 3 - RS485 Rear port 4 - ETHERNET port	RS-232/USB Frontal port (Craft Port)
Phone number	Phone number used for the Callout using a modem. This parameter will show on the screen only if the Output port selected (parameter above) is not the Ethernet port.	
IP address	IP address or domain name for the Callout destination. IP address format: NNN.NNN.NNN.NNN This parameter will display only if the port selected is the Ethernet port.	0.0.0.0
TCP port number	The port TCP number is like a channel used to make the connection with remote IP devices. Together with the computer IP address it completes the destination address for a communication session. This parameter will display on the screen only if the port selected is the Ethernet port.	2000
Repetition number	Number times call is to be repeated. Select: 0 to 9	3
Repeating Delay	Time between each re-try. Select: 2 to 480 minutes	10 minutes
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	0

8.1.6 Intelligent text message and partial TL-1 messages

The intelligent message text can be configured to contain up to 255 characters and a selection of programmable TAGs (see below) that can be integrated into the message. These TAGs are used to display information of selected parameters or limited TL1 alarms. When the message is sent the TAGs are replaced by the actual state of the parameters.

List of TAGs that can be integrated in the intelligent message:

Informational and text formatting TAGs

<CHANVAL:mnemo>	TAG used to add the value of a selected channel
<VIEW:view number>	TAG used to add the value of the channels list of a selected view
<SNAME>	TAG used to add the site name/location
<MNAME>	TAG used to add the network machine name
<DATE>	TAG used to add date (YY-MM-DD)
<TIME>	TAG used to add time (HH:MM:SS)
<CR>	TAG used to add a carriage return
<LF>	TAG used to add a line feed
<CRLF>	TAG used to add a carriage return and a line feed
<SCOL>	TAG used to add a semicolon (;)

Alarms TAGs

<ALM:MNEMO>	TAG used to display the alarm mnemonic
<ALM:NAME>	TAG used to display the alarm name
<ALM:ST>	TAG used to display the alarm state (ON or OFF)
<ALM:OCC>	TAG used to display the alarm occurrence counter
<ALM:PRI>	TAG used to display the alarm priority level (CRI, MAJ, MIN or INF)

TL1 TAGs

<ALM:NTFN>	TL1 TAG used to display the alarm priority level notification code (CR, MJ, MN, NA or CL),
<ALM:CDE>	TL1 TAG used to display the alarm priority level alarm code (*C, **, * or A).

Example of using "TAG" to send to get the analog values.

F1A2 = Site Ambient Temperature

TH2 = High temperature threshold

G30 = Current Site Temp and is triggered by TH2*TSP3

TSP3 activates at //,:10, remains active for 57 seconds and is on a fixed interval period of 1 minute.

Callout 4 uses a trigger list of G30 and all transitions and has a message of <CHANVAL:F1A2>

So when TH2 is on, G30 activates callout 4 which sends Current Site Temp <CHANVAL:F1A2>. When TSP3 clears for three seconds and then turns ON again for 57 seconds, as long as TH2 is still active the value displayed in Netcool is updated. This will allow the NOC to see what appears to be a dynamic temperature value and if it is increasing or decreasing. Netcool is able to assign a severity to the alarm based on the value received in domeTrapString. So, <90oF is a major and >=90oF is critical. Once the temp drops back below the threshold, G30 clears and the temp value is no longer displayed in Netcool.

The same could be done for battery run down voltage during commercial AC power Failure.

8.1.7 Keepalive

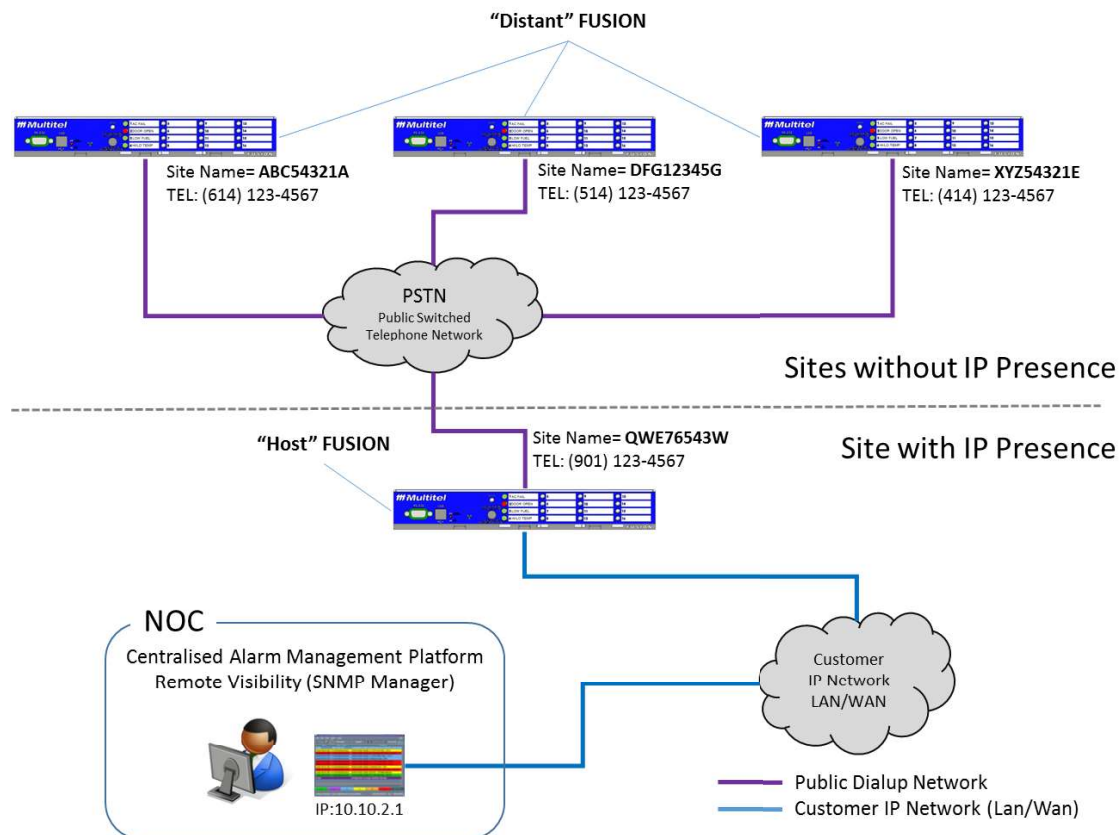
A “Keepalive” is a periodic signal generated by a programmable delay **DEL[x]** channel in order ensure the communication link is operational between a FUSION and a final destination server. The “keepalive” operating mode available in the programmable delay channels is design to facilitate the setup of a keepalive strategy. To learn more about the programmable delay, go to [section 6.3](#) of this manual.

8.2 DIALUP BRIDGE (8)

FUSION provides 8 user programmable dialup bridge channels to configure in a **Host FUSION** the site name of up to eight (8) **Distant FUSIONS**.

The purpose of these channels is to enable a **Host FUSION** to receive and process raw text message of Callouts coming from **Distant FUSION** installed in remote locations where there is no IP presence. With this feature, raw text alarm messages content from **Distant FUSION** can be transformed in a SNMP trap by the **Host FUSION** and sent to a final destination server like a Centralized Alarm Management Platform at the NOC. See following figure.

Figure 8 – Dialup bridge general concept



The eight (8) Dialup bridge **DB[x]** channels are user configurable. One (1) Dialup bridge **DB9** channel is user configurable but reserved for sending pre-determined error message. The **DB[x]** channels are displayed on the HTTP(S) interface under the **Derived channels** top menu and selecting **Dialup bridge** left submenu.

Each **DB[x]** channel is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Dialup bridge** on the left submenu. Click on one of the desired **DB[x]** to be configured.

Table 51 - DB[x] Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each Channel can be associated with an alarm level type: Not Logged, Informational, Minor, Major or Critical.	Info
Source Site Name	This is where you enter the "Site Name" of the FUSION where the callout will originate from. The "Site Name" must be identical, case sensitive. For the DB[9] channel, leave blank, the error message will be contiguous to the message being transmitted.	Not Programmed
Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	

The **DB9** channel is used to generate error messages which can occur during the alarm message transfer process. The following four (4) error messages will be contiguous to the alarm message being processed.

1. "received from unknown source!" – This message is provided when the source « site name » entered is not entered correctly or is not found in the list of configured **DB[x]** channels.
2. "message received but transmit channel is disabled!" – corresponding **DB[x]** channel is not enabled.
3. "received message is too long!" – The originat message received is too large.
4. "receive timeout!" – Started receiving data, but inactivity delay expired (2.1 second delay not user configurable).

8.2.1 Dialup bridge application example

The Dialup bridge **DB[x]** feature make use of a combination of various software functions in both the **Distant FUSION** and in the **Host FUSION**.

Software function used in the **Distant FUSION**:

1. Callout **COUT[x]** – To originate a MODEM call in "ASCII/ACK" format to the **Host FUSION** phone number
2. Programmable Delay **DEL[x]** – To trigger a Callout to the **Host FUSION**
3. Programmable groups **G[x]** – To regroup all of the **COUT[x]** mnemonics when multiple Callout are used to report back to the **Host FUSION**.

Software function used in the **Host FUSION**:

1. Dialup bridge **DB[x]** – To configure the "Site Name" which will be used as the identifier when processing incoming Callouts from **Distant FUSION**.
2. Callout **COUT[x]** – To originate a SNMP trap over Ethernet to the final destination server.
3. Programmable Delay **DEL[x]** – To trigger a SNMP trap Callout over Ethernet to the final destination server.
4. Programmable groups **G[x]** – To regroup all of the **DB[x]** or **COUT[x]** mnemonics when multiple Distant FUSION are reporting back to the **Host FUSION**.
5. Setup the **MODEM port protocol** to 4:Dialup Bridge. Be carefull when doing so, the Dialup Bridge protocol will prevent the FUSION from processing standard terminal sessions as the Dialup bridge protocol is a machine to machine protocol.

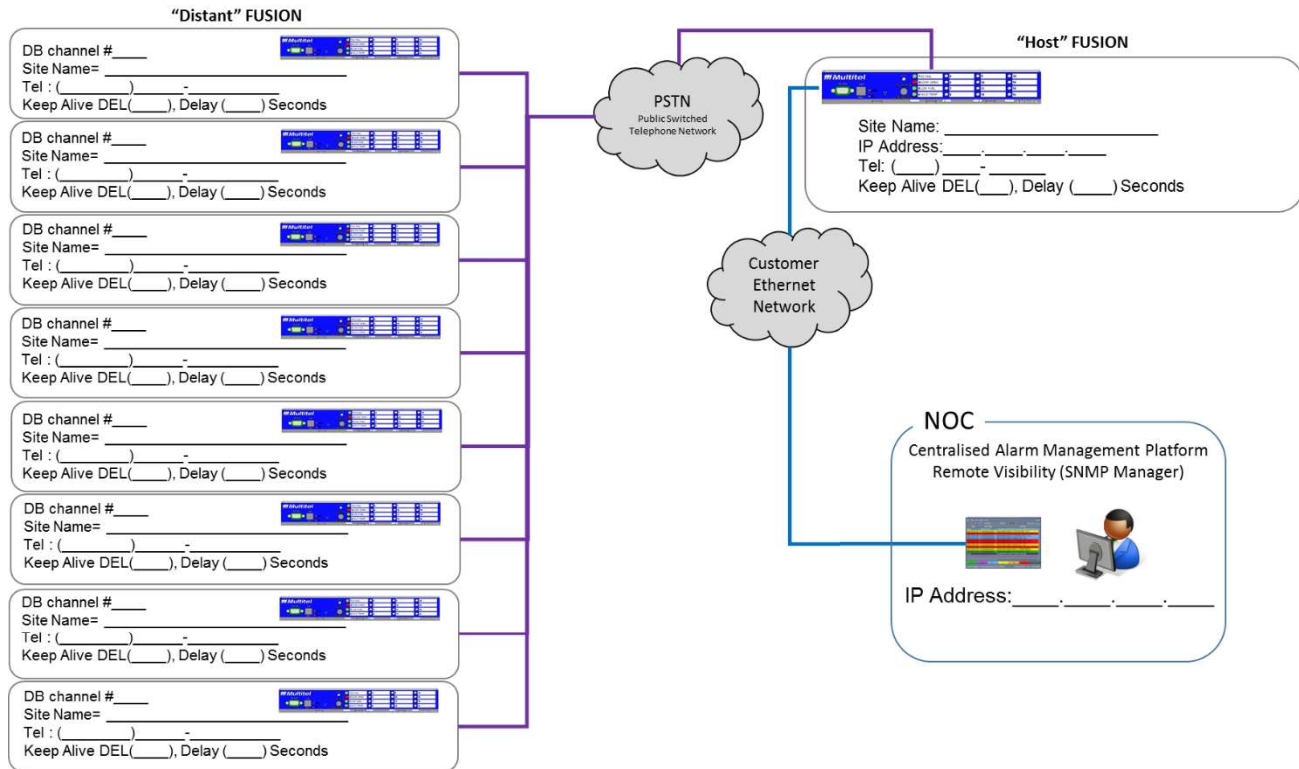
In principle the intent of the Dialup bridge feature is fairly simple to understand, however it reality, configuring the channels accordingly, it will require patience and rigour.

The **Host FUSION** receives the text message over the new "ASCII/ACK callout protocol" and transposes the integrality of the message content into an email or a SNMP trap to a final destination server. The **Host FUSION** modem protocol must be set to "ASCII/ACK" in order to received the Callouts orinated by **Distant FUSION** (See the important note below). If **Host FUSION** is not equipped with a MODEM, the "MODEM not installed" message

will display, please contact your Multitel representative to discuss the upgrade procedure and cost associated with it.

Therefore we recommend the following step by step procedure to configure the desired result.

Figure 9 – Dialup bridge reference diagram



IMPORTANT NOTE:

The selection of the **“Dialup bridge”** protocol for the Host FUSION’s MODEM port will prevent remote user from making and processing a standard terminal session. The **“Dialup bridge”** is a machine to machine protocol and therefore the Command Line Interface commands used by human to interface with the FUSION are no longer available to users. To revert back, use the Ethernet port or local USB/RS-232 to modify the MODEM Port protocol. The **“Dialup bridge”** protocol selection is only required on **Host FUSION**.

Step#1 – Build a sketch of what you want to achieve, this drawing will be usefull a reference. Acquire the critical information such as phone number, site names and IP addresses of all the FUSION involved. Use the above figure as a guideline. We recommend starting the configuration with the **Host FUSION** and moving on to each of the **Distant FUSION**.

If you have any concerns, please do not hesitate to contact our technical support staff.

Step#2 – Configure a **DB[x]** channel for each **Distant FUSION** that reports back to the **Host FUSION** (8 maximum).

- Name** = Give a name to the channel, may the location name, facility name or facility code.
- Alarm Level** = Select your preference, it does not impact the process.
- Source Site Name** = Enter the **Distant FUSION**’s site name, must be exact, watch for blank space and case sensitive.

Step#3 – Repeat step#2 for each **Distant FUSION**.

Step#4 - Configure the **DB[9]** error messages for the **Host FUSION**

State = Set to Enable to get the error message.

Name = Leave Blank/Not Used.

Alarm Level = Select your preference, it does not impact the process.

Source Site Name = Leave blank/Not used.

The **DB9** channel only requires to be “Enabled” to operate properly. The operating parameter for this channel are not mandatory as the channel will add the following error message to the current SNMP trap being sent to the final destination server:

- “received from unknown source!” – This message is provided when the source « site name » entered is not entered correctly or is not found in the list of configured **DB[x]** channels.
- “message received but transmit channel is disabled!” – corresponding **DB[x]** channel is not enabled.
- “received message is too long!” – The originat message received is too large.
- “receive timeout!” – Started receiving data, but inactivity delay expired (2.1 second delay not user configurable).

Example of Dialup bridge channel configuration in HTTP(S) interface

The screenshot shows the FUSION Multitel web interface. The top header includes the FUSION logo and a Logout button. Below the header, there's a status bar showing "MTQC175-2500: Multitel Demo unit located at 175-2500 Jean-Perrin Street, QC G2C1X1". The main content area is titled "Dialup bridge" and contains a table with configuration details for DB1.

DB1	Value
The channel state is	Enabled
The name is	FUSION dialup bridge
The alarm level is	Major
The source site name is	MTQC175-2500
The occurrence number is	0

Navigation links in the sidebar include: Binary Manual, Callout, Chronometer, Communication Ports, Constant, Daily Statistics Channel List, Dialup bridge, Duty Cycle/Average, and EMAIL Protocol. The main content area also has "Edit" and "Apply" buttons.

Step#5 - Setup a keepalive strategy (Not mandatory).

The suggested keepalive strategy requires that special configuration be also performed in each **Distant FUSION**. If no keepalive strategy is desired, move to step#6 configuring the Callout.

In summary, the keepalive strategy uses programmable delay **DEL[x]** channel to generate Callout from the **Distant FUSION** to the **Host FUSION** on a periodic basis. One (1) programmable delay is configured per **Distant FUSION**. The programmable delay **DEL[x]** operating mode is set as a “Keepalive”. The **DEL[x]** channel will then act as a resettable countdown timer and will initiate at the configured “Keepalive delay value” and start counting down. Whenever the triggering source configured as the “Keepalive delay reset source” activates, the corresponding **DEL[x]** channel will re-initialized the countdown timer. Thus, the objective is for each Distant FUSION to report back to the Host FUSION on a periodic basis, if no callout is received, the corresponding DB channel ou COUT channel will not reset the DEL(x) and the DEL(x) will expire and corresponding DEL(x) will become true and will be use to trigger a warning message (Ex.: SNMP trap) to advise the NOC of a malfunction in the communication link between the **Distant FUSION** and the **Host FUSION**.

In the **Host FUSION**, configure a programmable delay **DEL[x]** accordingly for each **Distant FUSION**:

- Name** = XYZ FUSION communication problem (The name is used as the warning message).
- Operating Mode** = Keepalive.
- Keepalive reset source** = use the specific **DB[x]** or **COUT[x]** mnemonic for that specific **Distant FUSION**, the objective is to re-initialized the delay in order to prevent a warning message to the NOC.
- Keepalive delay** = enter *24h or 86400 (a 24h recurrence is recommended).
- Repeat this step for each **Distant FUSION** reporting to the **Host FUSION**.

*The keepalive delay should be large enough to provide a **Distant FUSION** at least two reporting occurrences. If many Distant FUSION are reporting to the same Host FUSION is it recommended not to synchronised the programmable delays to report all at the same time.

Setup the keepalive in the **Distant FUSION** (This step is not necessary if no keepalive strategy is setup in the Host FUSION.).

As suggested before, the keepalive strategy requires that the following programmable delay configuration be performed in the **Distant FUSION**. The programmable delay is configured as a “keepalive” operating mode. The objective of the programmable delay is to trigger a callout when no callouts have been generated for an extended period of time. When the keepalive delay expires, the corresponding **DEL[x]** will generate a dialup callout to the **Host FUSION** and prevent it from sending in turn a communication warning message, however a “Keepalive message” will be sent to the final destination.

Thus, configure a programmable delay **DEL[x]** as follow:

- a. **Name** = XYZ FUSION Keepalive.
- b. **Operating Mode** = Select “Keepalive”.
- c. **Keepalive reset source**= Only one triggering source is allowed, thus use the corresponding **COUT[x]**. If many callouts are configured, use a group **G[x]** to reset the keepalive delay. This will prevent the **Distant FUSION** from sending a Keepalive callout to the **Host FUSION**.
- d. **Keepalive delay** = Enter *11h (39600 sec) – As suggested in the **Host FUSION** configuration, the **Distant FUSION** delay value should be set to occur at least twice within the **Host FUSION** delay value.

*Keep in mind that a dialup session can tak as long a 60 seconds from start to finish.

Step#6 - Configure a specific **COUT[x]** for each **DB[x]** channel.

To complete the process, the dialup bridge **DB[x]** channel is used as triggering source to generate a Callout to the final destination server (Ex.: SNMP Manager). When the Callout is triggered by the activation of the **DB[x]** triggering source, the message field is left empty as the message content is the one saved in the database coming from the original callout. If the Keepalive strategy is in place, the corresponding **DEL[x]** channel is also use a triggering source for the same callout and the message field can then be configured with a warning message as when the **DEL[x]** activates the callout, the configured message content will be sent to final destination server.

The Callout in the **Host FUSION** is configured accordingly:

- a. **Name** = Enter a significant name like “Alarm bridge from TAMPA12345 FUSION”.
- b. **Enter protocol** = Trap SNMP.
- c. **Enter Message**= If no keepalive setup, leave the message field blank, the message sent will be filled from the message content of the Callout received from the **Distant FUSION**. However, if a Keepalive is configured as a triggering source, consider editing a message like “There is a communication problem with the Distant FUSION, the keepalive <ALM:MNEMO>; <ALM:NAME> has expired”.
- d. **Enter triggering sources** = Enter a single **DB[x]** channel and the **DEL[x]** associated with the specific **Distant FUSION**.
- e. **Enter transistion** = Select “OFF to ON” only.
- f. **Enter destination manager** = Select from the list of SNMP Manager preprogrammed in the **Host FUSION**.

Step#7 – Configure the **Host FUSION**’s MODEM Port to operate with the “**ASCII/ACK**” protocol.



IMPORTANT NOTICE: The “**Dialup bridge**” protocol is a machine to machine protocol, thus when active, the remote access to the command line interface will no longer operate and may prevent remote access to the FUSION.

Go to Communication Port and select **COMIPOINT** :

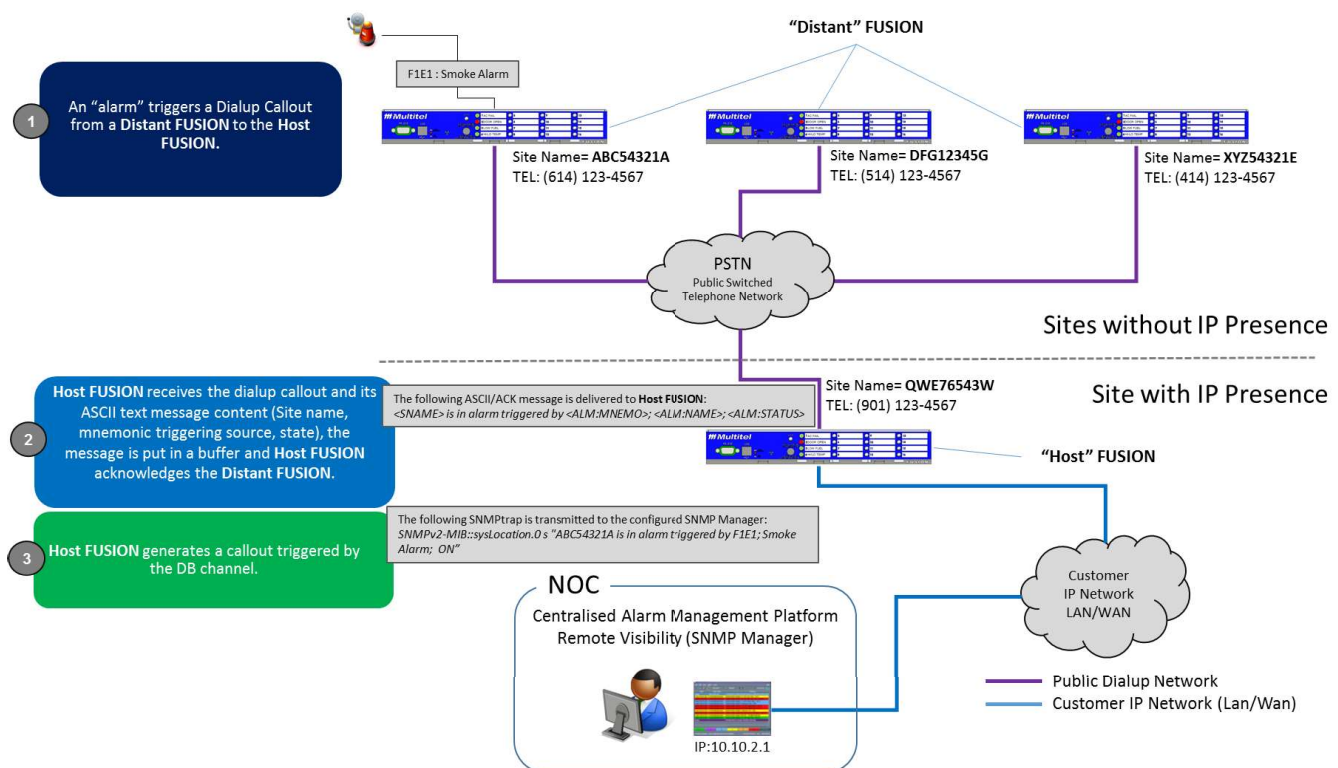
- a. **Protocol** = Enter the “4: “**Dialup bridge**””. – See the important note above.

- b. **Enter speed** = We recommend selecting 9600 Baud and recommend arranging the MODEM speed for all Distant FUSION to the same speed selected.

Step#8 - Configure one or more callout **COUT[x]** to report alarms from the **Distant FUSION** to a **Host FUSION**.

- c. **Name** = Enter a significant name like "Alarm bridge from TAMPA12345 FUSION".
- d. **Enter protocol** = Select the ASCII/ACK format.
- e. **Enter Message** = The message must have the TAG <SNAME> as the first element of the message. After the Site Name TAG, up to 255 characters with other TAGs are available to build the alarm message.
- f. **Enter triggering mode** = Select between triggering source list or alarm level.
- g. **Enter triggering sources** = Enter a list of triggering sources or select the desired alarm level based on what was selected in the previous parameter.
- h. **Enter transition** = Select as per your requirements.
- i. **Enter output port** = Select "Internal MODEM".
- j. **Enter phone number** = Enter the phone number of the **Host FUSION**.
- k. **Enter repetition number** = Enter the maximum number between 0 to 9 occurrence, we recommend selecting 9 occurrences.
- l. **Enter repeating delay**: Enter a repeating delay between 2 to 480 minutes. We recommend selecting a 3 minute repeating delay.

Figure 10 – Dialup bridge Example



FAQ – Frequently asked Questions about the Dialup Bridge?

Q1. What happens when a **Distant FUSION** generates a Callout and a new alarm with a higher level of severity occurs?

The **Host FUSION** will complete the actual callout and will pass to the next callout, there is no special process for higher level of priority in the course of action, it is first come, first serve.

Q2. Is the Keepalive strategy required for the dialup bridge to operate?

No, the keepalive strategy is not mandatory, however it is a good practise to have **Distant FUSION** reporting to the **Host FUSION** from time to time to validate the communication link and configuration are operational.

Q3. What are the odds of losing alarms?

If the site is in a very remote area, the Public Switch Telephony Network is poor quality, the communication link QoS may affect the odds of losing alarms. Also, in a regional outage where many **Distant FUSION** reporting to the same **Host FUSION** are affected, the **Host FUSION** could be overflowed with calls to process.

Q4. If the **Host FUSION** is busy with another **Distant FUSION**, will the alarm(s) be transferred to the NOC?

Yes, the **Distant FUSION** will retry as long as the corresponding triggering source is active, and the call will go thru.

Q5. What happens in the event of an AC Failure, many redundant triggering source in the **Distant FUSION** can become active simultaneously?

The Distant will perform the callout to the Host FUSION and will transmit as many alarm message as there are triggering source activated. All these message are delivered in a single Callout. The **Host FUSION** will also generate one (1) Callout to the final destination server and deliver as many message as it received. Thus consider using the "alarm level" triggering method and use of TAGs in your message content to keep track of the alarm source. For more information on TAGs, see the [section 7.1.6](#)

8.3 THRESHOLDS (1500)

FUSION provides 1500 programmable thresholds. These are used to set up alarms or controls when an analog measurement or occurrence counter exceeds the associated set value. Each threshold is independent and can be attached to an internal analog channel (FxAy), a MODBUS module channel (MxAy), an SNMPget module channel (GTxAy), an Expansion shelf's I/O card (CxAy), a derived (virtual) channel or to an occurrence counter. These channels are displayed on the HTTP(S) interface under the **Derived Channels** top menu.

When a threshold is attached to a real analog channel or a virtual analog channel the user must enter a constant value with which the measured analog channel value is compared. Each **TH[x]** channel is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Thresholds** on the left submenu. Select the **TH[x]** to be configured.

Parameters are different depending on the parameter selected. The following table displays configuration for a threshold attached to an analog channel.

Table 52 - TH[x] Configuration Parameters (analog channel)

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Assignment	The threshold function is attached either to an analog channel or to an occurrence counter.	Analog channel
Analog source channel	Analog channel assigned to the threshold.	
Activation type	The thresholds function will be triggered with a "low", "high", "between" or "outside" comparison. See examples in the next sub-section.	Low
Alarm Level	Each Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info

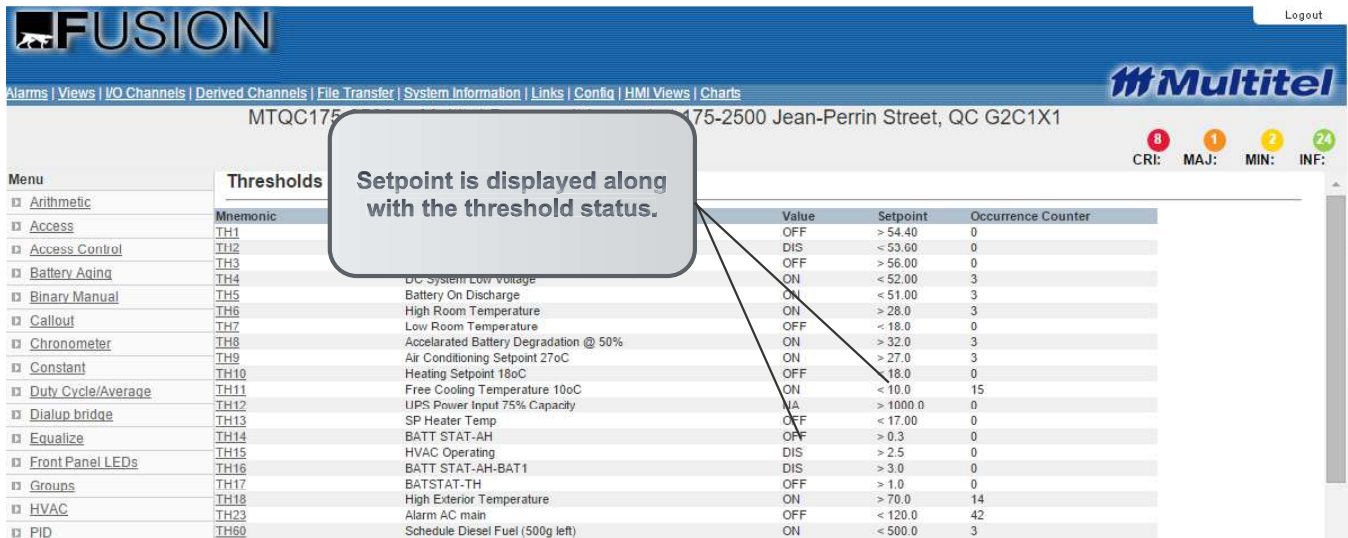
Parameters	Description	Default Value
Compare value	Constant value is used only for the “Low” or “High” activation type when compared to the selected analog channel’s value. Select: -10000000.00 to 10000000.00	0.00
Compare value (Low)	Constant value (Low) is used only for the “Between” or “Outside” activation type when compared to the selected analog channel’s value. Select: -10000000.00 to 10000000.00	0.00
Compare Value (High)	Constant value (High) is used only for the “Between” or “Outside” activation type when compared to the selected analog channel’s value. Select: -10000000.00 to 10000000.00	0.00
Hysteresis value	The hysteresis is used to prevent rapid switching between ON and OFF states when the value is close to activation level. The hysteresis value is like a buffer zone next to the activation level so when the threshold has been activated it will be deactivated only if the analog channel value is equal to the compared value +/- the hysteresis value. (+or - depends on the activation type) Select: 0.00 to 10000000.00	0.00
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	

The following table displays configuration for a threshold attached to an occurrence counter.

Table 53 - TH[x] Configuration Parameters (occurrence counter)

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Assignment	The threshold function is attached either to an analog channel or to an occurrence counter .	Analog channel
Source trigger	Triggering source. Its occurrence counter will be compared to a number of occurrences. See section 4.13 for the list of all possible triggering sources.	
Alarm Level	Each Channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info
Number of Occurrences	Constant value to be compared with the triggering source’s occurrence counter. Select: 0 to 10000000	0
Automatic reset of the Occurrence number	Automatic resetting of the triggering source’s occurrence counter. Select: No or Yes	No
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	

Example of threshold menu in HTTP(S) interface



MTQC175-2500 Jean-Perrin Street, QC G2C1X1

Logout

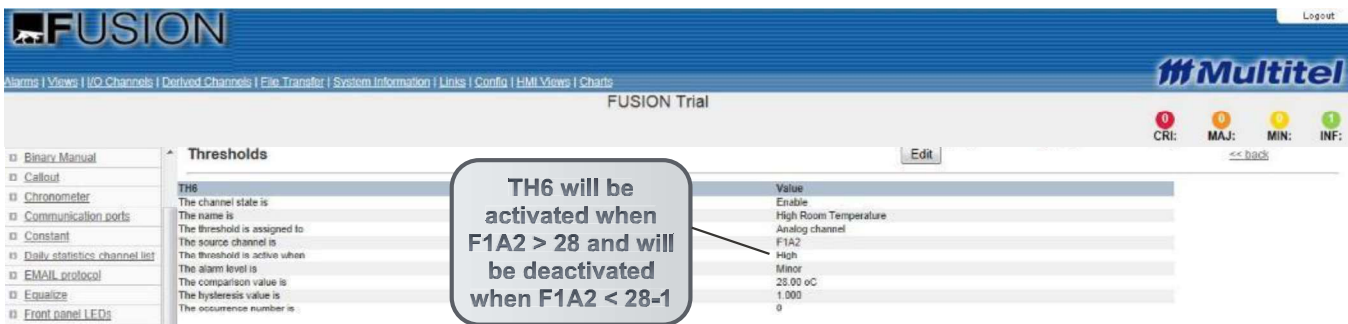
Alarms | Views | I/O Channels | Derived Channels | File Transfer | System Information | Links | Config | HMI Views | Charts

8 CRI: 1 MAJ: 2 MIN: 24 INF:

Menu	Thresholds	Mnemonic	Value	Setpoint	Occurrence Counter
Arithmetic	TH1		OFF	> 54.40	0
Access	TH2		DIS	< 53.60	0
Access Control	TH3		OFF	> 56.00	0
Battery Aging	TH4		ON	< 52.00	3
Binary Manual	TH5	DC System Low voltage	ON	< 51.00	3
Callout	TH6	Battery On Discharge	ON	> 28.0	3
Chronometer	TH7	High Room Temperature	OFF	< 18.0	0
Constant	TH8	Low Room Temperature	ON	> 32.0	3
Duty Cycle/Average	TH9	Accelerated Battery Degradation @ 50%	ON	> 27.0	3
Dialup bridge	TH10	Air Conditioning Setpoint 27oC	OFF	< 18.0	0
Equalize	TH11	Heating Setpoint 18oC	ON	< 10.0	15
Front Panel LEDs	TH12	Free Cooling Temperature 10oC	NA	> 1000.0	0
Groups	TH13	UPS Power Input 75% Capacity	OFF	< 17.00	0
HVAC	TH14	SP Heater Temp	OFF	> 0.3	0
PID	TH15	BATT_STAT-AH	DIS	> 2.5	0
	TH16	HVAC Operating	DIS	> 3.0	0
	TH17	BATT_STAT-AH-BAT1	OFF	> 1.0	0
	TH18	BATSTAT-TH	ON	> 70.0	14
	TH23	High Exterior Temperature	OFF	< 120.0	42
	TH60	Alarm AC main	ON	< 500.0	3
		Schedule Diesel Fuel (500g left)			

8.3.1 Threshold application examples

A threshold associated with an analog value. F1A2 represents the room temperature and the user wants to set TH6 to send an alarm when the temperature goes over 28°C. A second threshold is also required to send an alarm when the temperature goes below 18°C.



FUSION Trial

Logout

Alarms | Views | I/O Channels | Derived Channels | File Transfer | System Information | Links | Config | HMI Views | Charts

9 CRI: 0 MAJ: 0 MIN: 1 INF:

Thresholds

Edit

TH6

The channel state is: Enable

The name is: High Room Temperature

The threshold is assigned to: Analog channel

The source channel is: F1A2

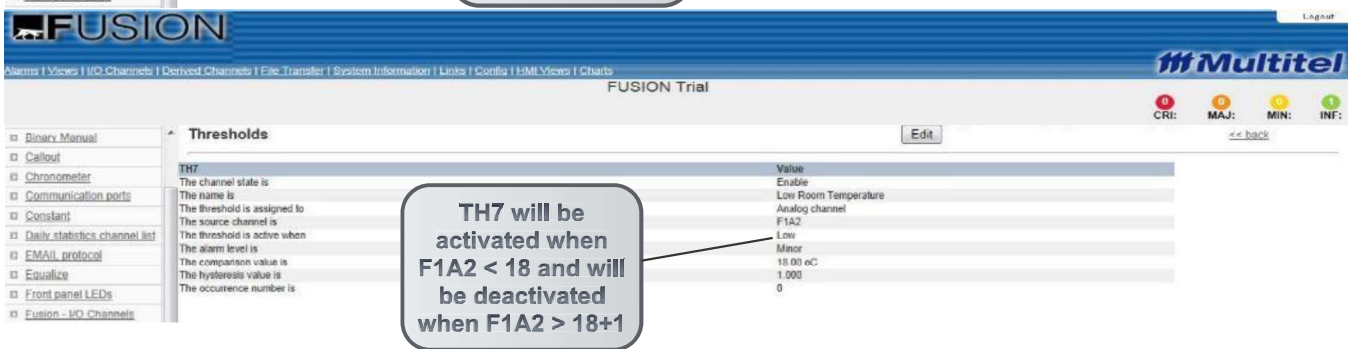
The threshold is active when: High

The alarm level is: Minor

The comparison value is: 28.00 oC

The hysteresis value is: 1.000

The occurrence number is: 0



FUSION Trial

Logout

Alarms | Views | I/O Channels | Derived Channels | File Transfer | System Information | Links | Config | HMI Views | Charts

9 CRI: 0 MAJ: 0 MIN: 1 INF:

Thresholds

Edit

TH7

The channel state is: Enable

The name is: Low Room Temperature

The threshold is assigned to: Analog channel

The source channel is: F1A2

The threshold is active when: Low

The alarm level is: Minor

The comparison value is: 18.00 oC

The hysteresis value is: 1.000

The occurrence number is: 0

Group G12 is created with the logic equation: TH6 OR TH7. G12 is activated each time the temperature goes over or under the set limits. Another Threshold TH20 is configured using the number of occurrences as the activation mode and G12 as the triggering source.

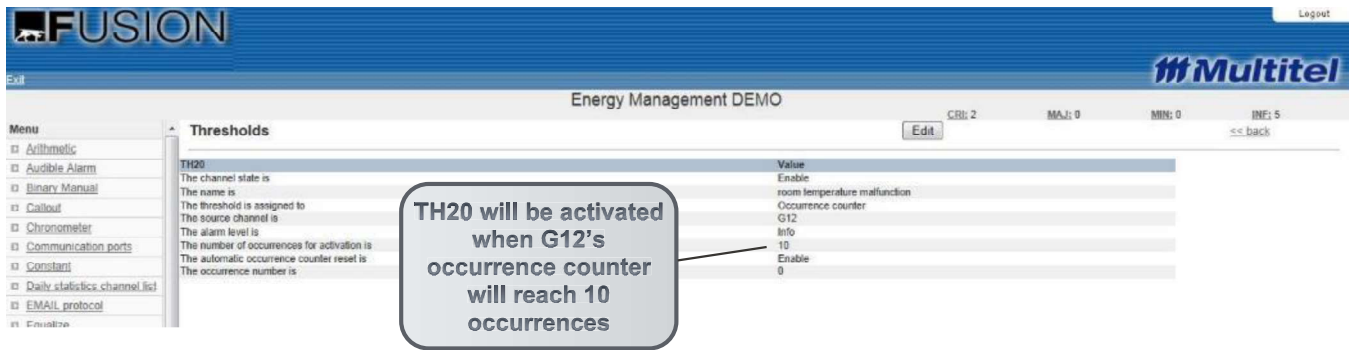


FUSION Trial

Logout

Alarms | Views | I/O Channels | Derived Channels | File Transfer | System Information | Links | Config | HMI Views | Charts

9 CRI: 0 MAJ: 0 MIN: 1 INF:



An alarm will be generated each time the temperature goes over or under the pre-set values and a second alarm will inform users that the room temperature when the set limits have been exceeded 10 times. E.g. the room thermostat may be defective, the HVAC system is faulty (check the HVAC alarms) or some configuration on site is not correct.

8.4 VIEWS (32)

The **Views** function is designed to integrate a limited number of different I/O channel types into a single screen display. Miscellaneous monitored and controlled points related to a specific application such as environment, DC power, generator etc. can be grouped together for easier and faster status report or analysis.

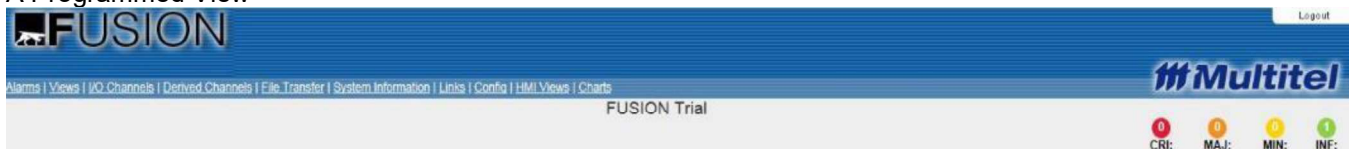
Thirty two (32) programmable views are available. Each **CVIEW[x]** channel is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Programmable views** on the left submenu. Click on the **CVIEW[x]** to configure.

Table 54 - CVIEW[x] Configuration Parameters

Parameters	Description	Default Value
Name	Channel identification. (Up to 40 characters)	Not Programmed
List of channels	Enter a list of channels to be displayed in the current view. The view can contain up to 32 elements. Only the active channels of a view will be displayed on the HTTP(S) page. This simplifies the display for ease of use. Each element may correspond to: an analog channel (real or virtual), binary input channel, relay output channel, constant channel, or any triggering source.	

To display a programmed View on the HTTP(S) interface select **Views** located on the top menu. The left sub-menu displays all available programmed views. Click the one to be configured.

A Programmed View





8.5 CHRONOMETERS (10)

A chronometer channel enables the user to time certain events. (E.g. generator usage) FUSION has 10 chronometer channels: ACHR[x]. These channels are displayed on the HTTP(S) interface under the **Derived channels** menu.

Each **ACHR[x]** channel is individually programmable. Click on **Config** on the top menu (Supervisor access only) and then choose **Chronometer** on the left submenu. Click the 10 **ACHR[x]** channel to be configured.

Table 55 - ACHR[x] Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Triggering source	Enter the triggering source. Refer to Table 31 and Table 32 (Binary Fail signals) for the list of available triggering sources.	
Display option	It is possible to display the Chronometer channel in seconds, minutes or hours.	seconds
Operation mode	The Chronometer has two modes of operation. In the cumulative mode, the timer will continue counting every time the triggering source is ON. In the non-cumulative mode, the timer will be reset to zero upon each transition to ON of the triggering source. Select: non-cumulative or cumulative.	non-cumulative
Unit	Displayed unit, maximum of 5 characters. Ex: Watt, kWatt.	Not Programmed
Triggering source for resetting occurrence counter	Entering a triggering source will automatically reset the chronometer's occurrence counter when triggering source becomes true.	Not programmed

In cumulative mode use the "RESET" command in the Command Line Interface to manually reset the channel or to enter an initialisation value.

8.5.1 Application example for chronometers

An example the chronometer feature is used to monitor total battery discharge time in cumulative mode. A chronometer is configured (ACHR3) using the TH2 signal as triggering source. TH2 monitors the DC system

voltage and will be captured if the voltage falls below a certain pre-set value. ACHR3 is configured in minutes and in cumulative mode. Each time TH2 is active the chronometer begins counting. The result is a time value in minutes which indicates total battery discharge time.

8.6 WATTHOUR CHANNELS (AWH) (10)

FUSION can calculate the energy consumption of a DC power plant. The user can set up and (and also reset) various energy counters specific to each power plant application and architecture using the Current, Voltage and Watthour channel. These channels are displayed on the HTTP(S) interface under the Derived channels top menu.

Each **AWH[x]** channel is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Watthour** on the left submenu. Click on the 10 **AWH[x]** to be configured.

Table 56 - AWH[x] Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Unit	Watthour channel's output unit. Maximum of 5 characters.	Not Programmed
Unit prefix	Prefix for the unit. Select: None, Kilo or Mega.	None
Current channel	Enter the selected current channel for the application.	
Voltage channel	Enter the selected voltage channel for the application.	
Triggering source	Enter the triggering source. Refer to Table 31 and Table 32 (Binary Fail signals) for the lists of available triggering sources.	
Operation mode	This parameter is displayed only when a triggering source has been configured. The Watthour channel can be set to work in cumulative or non-cumulative mode. In the cumulative mode the total Watthour is counted every time the triggering source is in the ON state. In the non-cumulative mode the channel is reset to zero upon each transition to ON of the triggering source.	Non-cumulative

Use the "RESET" command via the Command Line Interface to manually reset the channel or to enter an initialisation value. (Command Line Interface Refer to section [5.2](#))

8.6.1 Application example for AWH channels

The daily rectifier energy consumption can be calculated using the plant voltage, the DC system load and a TSP1 restarting every 24 hours. The AWH channel is configured in kWh, is set to non-cumulative mode and resets each time the TSP1 restarts, every 24 hours.

8.7 ARITHMETIC CHANNELS (220)

These channels enable FUSION to perform basic to complex arithmetic calculations between: analog channels, Expansion shelf I/O cards, MODBUS module values, SNMPget module values, arithmetic, and constant channels. These channels are displayed on the HTTP(S) interface under the **Derived channels** menu.

Each **AAR[x]** channel is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Arithmetic** on the left submenu. Click on the 220 **AAR[x]** to be configured.

Table 57 - AAR[x] Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Unit	Arithmetic channel's output unit. Maximum of 5 characters.	Not Programmed
Number of decimal digits	Value representation: Choice Between 0 and 4 digits where 4=auto	4
Equation	For the equation, each source can be preceded by the negation operator (-). Parenthesis "(" and ")" may be used (maximum 12 pairs) as well as operators +, -, * or /. Maximum of 225 characters or 25 terms.	

8.7.1 Arithmetic application example

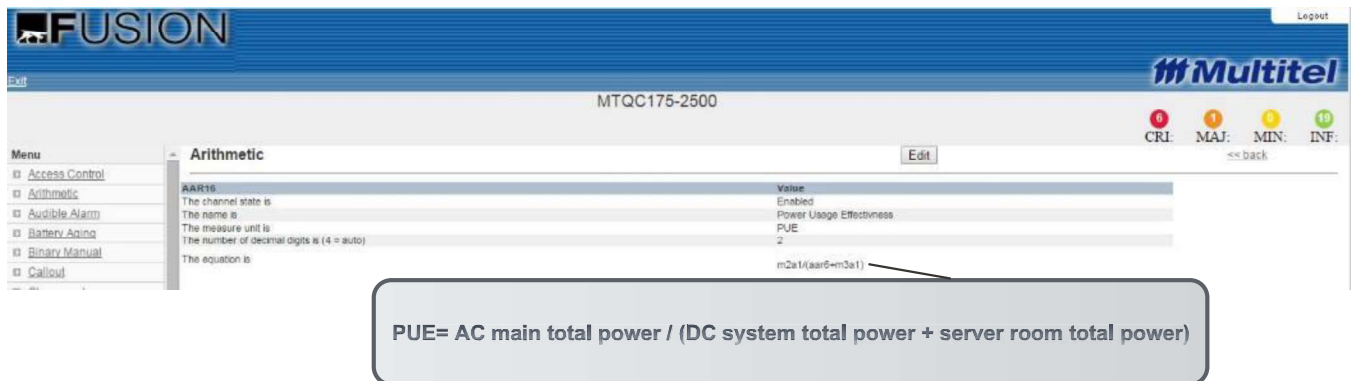
Ambient to Battery Cell Temperature Difference: Room temperature (Channel F1A6) and a specific cell (Channel F1A7) within a battery string. Equation: F1A6-F1A7

This example demonstrates the potential behind the arithmetic computation. The equivalent of the following equation is F1A1*100-47, as CONST14 is set to 30.

Equation: F1A1*100 +CONST14/10-20*2.5

"H" for help, max 225 characters or 25 terms

Power Usage Effectiveness (PUE) calculation is another example. Configuration parameters for AAR16:



The screenshot shows the FUSION Multitel interface. The main configuration area displays the following parameters for AAR16:

Parameter	Value
The channel state is	Enabled
The name is	Power Usage Effectiveness
The measure unit is	PUE
The number of decimal digits is (4 = auto)	2
The equation is	m2a1(aar5+m3a1)

A callout box highlights the equation: $PUE = \text{AC main total power} / (\text{DC system total power} + \text{server room total power})$

See section 8.8.1 for another arithmetic channel application example.

8.8 CONSTANT CHANNELS (32)

These channels enable FUSION to save constant values as references to be used in arithmetic computation or as a set point channel for a Proportional Integral Differential (PID). E.g. AC Mains entrance capacity in Amps, Fuel Tank Capacity in gallons or liters, DC System Capacity in Amps, UPS capacity in kW, energy price per kilowatt/hour, HVAC Capacity and so on.

Thirty-two (32) **CONST[x]** channels can be configured. These channels are displayed on the HTTP(S) interface under the **Derived channels** menu.

Each **CONST[x]** channel is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Constant** on the left submenu. Click on one of the 32 **CONST[x]** to be configured.

Table 58 - CONST[x] Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Unit	Constant channel unit. Maximum of 5 characters.	Not Programmed
Number of decimal digits	Value representation: Choice Between 0 and 4 digits where 4=auto	4
Constant value	Choice : $-1e^{32}$ to $1e^{32}$	0

8.8.1 Constant application example

DC Power System Utilisation Level with Notification: CONST1 is set to 500 Amps according to the DC Power System Capacity. DC system load is measured continuously by F1A2.

The arithmetic channel AAR1 is configured with the following equation:

$(F1A2/CONST1) * 100$ to calculate the level in percent at which the DC power system is utilized in real time. A High Threshold TH[x] can be used to create a trigger when the utilization level exceeds 65%. The corresponding TH[x] triggering source is used to trigger a SNMP trap and to advise the engineering staff of the condition.

8.9 DUTY CYCLE/AVERAGE CHANNELS (10)

A Duty Cycle/average channel is used to calculate the percent of time that a selected value spends in an active state as a fraction of the total time allowed for the evaluation. There are various applications for the Duty Cycle/average channels, some example could be: generator run time, battery backup on time, HVAC daily usage, DC power utilisation...

Ten (10) Duty Cycle/average channels can be configured. These channels are displayed on the HTTP(S) interface under the **Derived channels** menu. Each DCC[x] channel is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Duty Cycle/average** on the left submenu. Click on one of the 10 **DCC[x]** to be configured.

Table 59 - DCC[x] Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Unit	Constant channel unit. Maximum of 5 characters.	Not Programmed
Number of decimal digits	Value representation: Choice Between 0 and 4 digits where 4=auto	4
Source channel	Enter the selected source channel, the one that needs to be evaluated. (ex: DC power on)	Not Programmed
Computation start time coordinate	<p>Enter the coordinate corresponding to the time you want the recording to start. Please note that when the parameter for computation start time is modified, the time period allocated for the previous coordinate needs to be completed before the new coordinate's activation. To activate the new parameter right away (before the end of the time period), the DCC[x] channel has to be disabled and then enabled again to ensure that synchronizing the new coordinate is done properly.</p> <p>There are two different formats for the coordinates:</p> <ol style="list-style-type: none"> 1. This format is used when a weekly start time coordinate is needed. The format is as follows: Day of the week,HH:MM:SS (ex: Monday,0:0:0 means each Monday at midnight) In this format, the day of the week is mandatory. The other fields, namely HH, MM and SS are optional (when there is no value, it is equivalent to a 0 for the beginning of the hours, minutes or seconds). 2. This format is used when a setting at precise day, hour or minute is needed. The format is as follows: /MM/DD,HH:MM:SS (ex: //1,0:0:0 means first day of each month at midnight) In this format, all fields are optional (when there is no value on the separator's left side, the corresponding field is ignored; but when there is no value on the separator's right side, the actual value representing the field is taken). <p>For both formats, separators are mandatory.</p>	Not Programmed

Parameters	Description	Default Value
Computation period	Enter the total time you want the source channel to be evaluated. Format: xxxDxxHxxMxxS (from 1 second to 400 days)	Not Programmed

8.9.1 Configuration examples for the Computation start time coordinate parameter

For format 1:

tuesday,::0 Every Tuesday, at midnight (the same as tuesday,0:0:0)
friday,0:0 Every Friday, at midnight (the same as friday,0:0:0)
thursday,::30:0 Every Thursday, at midnight and 30 minutes (the same as thursday,0:30:0)

For format 2 :

//,::0 Every minute
//,0:0 Every hour
//,30:0 Every thirtieth minute of every hour
//1,7:0:0 Every first of the month at 7:00
/6/1,12:0:0 Every June 1st at noon

8.9.2 Duty Cycle/average application example

One example of the use of a Duty Cycle/average channel could be the HVAC Daily Usage. In this example, we want to know the percentage of time the HVAC system is switched on over a 24 hour period.

The image displays two screenshots of the FUSION software interface, illustrating the configuration of a Duty Cycle/Average channel (DCC1) and a Threshold channel (TH15).

Top Screenshot: Duty Cycle/Average Configuration

- Channel Name:** DCC1
- Channel State:** Enabled
- Name:** HVAC Daily Usage
- Measure Unit:** %
- Number of decimal digits:** 4 (auto)
- Source Channel:** TH15
- Computation Start Time Coordinate:** //,0:0:0 (Every day at midnight)
- Computation Period:** 1D (Every day)

Annotations:

- "The computation starts every day at midnight" points to the start time coordinate.
- "DCC1 will give the percentage of time the channel TH15 has been activated over a period of one day" points to the computation period.

Bottom Screenshot: Threshold Configuration

- Channel Name:** TH15
- Channel State:** Enabled
- Name:** HVAC Operating
- Assigned To:** Analog channel
- Source Channel:** M3A1
- Threshold Value:** 2.500 kW
- Alarm Level:** High
- Comparison Value:** Info
- Hysteresis Value:** 0.500
- Occurrence Number:** 2

Annotations:

- "M3A1 is the server room total power" points to the source channel.
- "When M3A1 reaches 2.5 KW, TH15 is activated, meaning the HVAC is operating" points to the threshold value.

8.10 LOOKUP TABLE CHANNELS (4)

A Lookup Table channel is used to validate input values by matching against a list of valid terms in an array and enables to process the matching input accordingly. Some sensors like thermistors, RF Power meters do not provide a linear output signal producing erratic measurements when read directly using an SMX or FUSION analog input channel. The Lookup Table channel provides a mean to eliminate the offset by providing a set of valid/real values for a portion of the full input measurement range.

Four (4) Lookup Table channels can be configured. These channels are displayed on the HTTP(S) interface under the **Derived channels** menu. Each LKU[x] channel is individually programmable. Click on **Config** from the top menu (Supervisor access only) and then choose **Lookup Table** on the left submenu. Click on one of the 4 **LKU[x]** to be configured.

Table 60 - LKU[x] Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Unit	Constant channel unit. Maximum of 5 characters.	Not Programmed
Number of decimal digits	Value representation: Choice Between 0 and 4 digits where 4=auto	4
Input channel	Enter the selected source channel, the one that needs to be evaluated. (ex: DC power on)	Not Programmed
Enter the Lookup Values	Enter lookup table values in the form of comma ',' separated list of paired values. The first of the 2 values is the input, second is the corresponding real value and both values are separated by an equal sign. Exp: 0.5=2.2, 0.75=3.1, ... ('H' for help, 'C' to clear) - Your entry will only be visible after using the "Apply" button. The array can be composed as many as 65 535 couple (measured value, real value)	Not Programmed

8.10.1 Configuration examples for a RF Power Meter

The RF Power meter provides the mean to measure the RF transmitter output power and it is usually installed after the filtration of many transmitters. The RF power meter provides a proportional voltage signal which can be impacted by the RF transmitter frequency, thus measurement imprecisions can be obtained between the real power output value and the FUSION measured value. Thus a Lookup table channel can be configured to correct the offset along the measurement range. For an example, the following correspondence table can be configured

Measured Voltage	Real Power
0.134 V	0.1 W
0.156 V	0.2 W
1.234	2 W

The above table will be entered as follow :
0.0=0.0, 0.134=0.1, 0.156=0.2, 1.234=2

Lookup table		Edit
LKU1	Value	
The channel state is	Enabled	
The name is	PUISSANCE TRANSMISE	
The measure unit is	W	
The number of decimal digits is (4 = auto)	0	
The input channel is	F1A2	
The lookup table values are	0.000=0.000, 0.134=0.100, 0.156=0.200, 1.234=2.000	

8.11 LEAD/LAG (4)

A lead/lag channel enables the user to cycle operation between 2 to 8 pieces of equipment over a determined period of time to ensure even wear of them. This channel type is typically used in BAS applications.

FUSION has 4 lead/lag channels identified by the following mnemonic: **LL[x]**. These channels are displayed on the HTTP(S) user interface under the **Derived channels** menu.

Each **LL[x]** channel is individually programmable. Click on **Config** on the top menu (Supervisor access only) and then choose **Lead/Lag** on the left submenu. Click on one of the 4 **LL[x]** channel to configure it.

Table 61 - LL[x] Configuration Parameters

Parameters	Description	Default Value
Module state	Disabled, Enabled or None. When none is selected, it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm level	Each channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Informational
Number of device	It is possible to use a lead lag between 2 to 8 devices	2
Enter period	Each channel can perform over a different period of operation, from 1 second to 366 days. The format is xxDaysxxHoursxxMinutesxxSeconds.	1D
Device 1 description	Device 1 description, maximum of 50 characters.	Not Programmed
Device 2 description	Device 2 description, maximum of 50 characters.	Not Programmed

It is important to note that lead/lag function is not visible in terminal emulation session, only through http or HTTPS interface. When displaying the status of lead/lag channel, the remaining time to present cycle is provided with list of controlled equipment and the one actually commanded.

8.11.1 Application example for lead/lag

A lead/lag channel LL1 is being used in a building automation application where there is a cycle of operation between three (3) HVAC systems. The alarm level is Informational. The device number one (1) is LL1E1 named HVAC A, device number two (2) is LL1E2 named HVAC B and device number three (3) is LL1E3 named HVAC C. The period entered is 2D. Every two (2) days, the lead/lag function will alternate operation between those HVAC systems. In summary, two (2) days after the initial lead/lag start, HVAC A will stop and HVAC B will relay and operate for two (2) days. After that period, HVAC B will stop and HVAC C will operate for the two (2) next days. The operation will then restart with HVAC A and so on. While this happen, the FUSION will generate alarms stating that LL1E1, LL1E2 or LL1E3 is now in operation.

9 SPECIFIC APPLICATIONS

9.1 SMART MODULE EXPANSION (SMX-48BI & SMX-24AI)

The Smart Module Expansion (SMX modules) were introduced in section 3.2. This section documents the SMX modules characteristics other than the module configuration in FUSION which is treated in section 4.8. with the other MODBUS modules. The SMX modules share the same design, however they come in two (2) types, a 48 binary input module and a 24 analog input module.

9.1.1 SMX module characteristics

The Smart Module Expansion provides the ability to expand the native I/O capacity of any FUSION remote monitoring device. The SMX module communicates status over a 2 wire EIA-485 network using MODBUS RTU protocol. FUSION can support a maximum of 32 modules, of either MODBUS or SMX modules on each of the EIA-485 port located on the FUSION back panel. Thus 32 modules on the RS-485 port and 32 modules on the MLINK port for a total of 64 modules all together.



The SMX modules has the following characteristics:

- Redundant, type A and B, 48Volts Power Supply (see Power/Aliment. table);
- High-speed communication via MODBUS RTU protocol. A speed rotary located on the front panel is used to set the speed. (Refer to the Speed rotary table to learn about the speed associated with the rotary number);
- Easy MODBUS address setting using two rotary on the front panel. The left rotary for tens and the right rotary for units. Ex.: for MODBUS address 64, left rotary = 6 and right rotary = 4.;
- A Power/Fail LED for troubleshooting (Refer to the Power/Fail LED table in the following troubleshooting section of this chapter);
- Plug'n play module, there is no need for configuring MODBUS registry;
- An LED indicating MODBUS communication status;
- A designation space to reference the "**M[x]**" Module identification;
- 48 binary inputs concentrated on a single "CHAMP" connector type to simplify pre-cabling (see I/O channel pin-out for the SMX-48BI); or
- 24 analog hybrid inputs concentrated on six (6) 8-pin screw type modular connector (Same as FUSION connectors)
- There is not lithium battery in the SMX-24AI, calibration values are kept and protected in the FUSION memory.

9.1.2 SMX module specifications

Following is a summary of the SMX module specifications. For more detailed information, visit the specification chapter.

Type	Component	Specifications
SMX Power and Environmental	Typical:	-48Vdc (2.4W)
	Range:	-40 to -60 Vdc
	Rec. Fused	1 1/3 Amp
	Oper. Temperature:	-40°F (-40°C) to 149°F (65°C)
	Humidity:	5 to 90 % RH (Non-condensing)
Dimensions	Height:	1.50 inch (3,81cm)

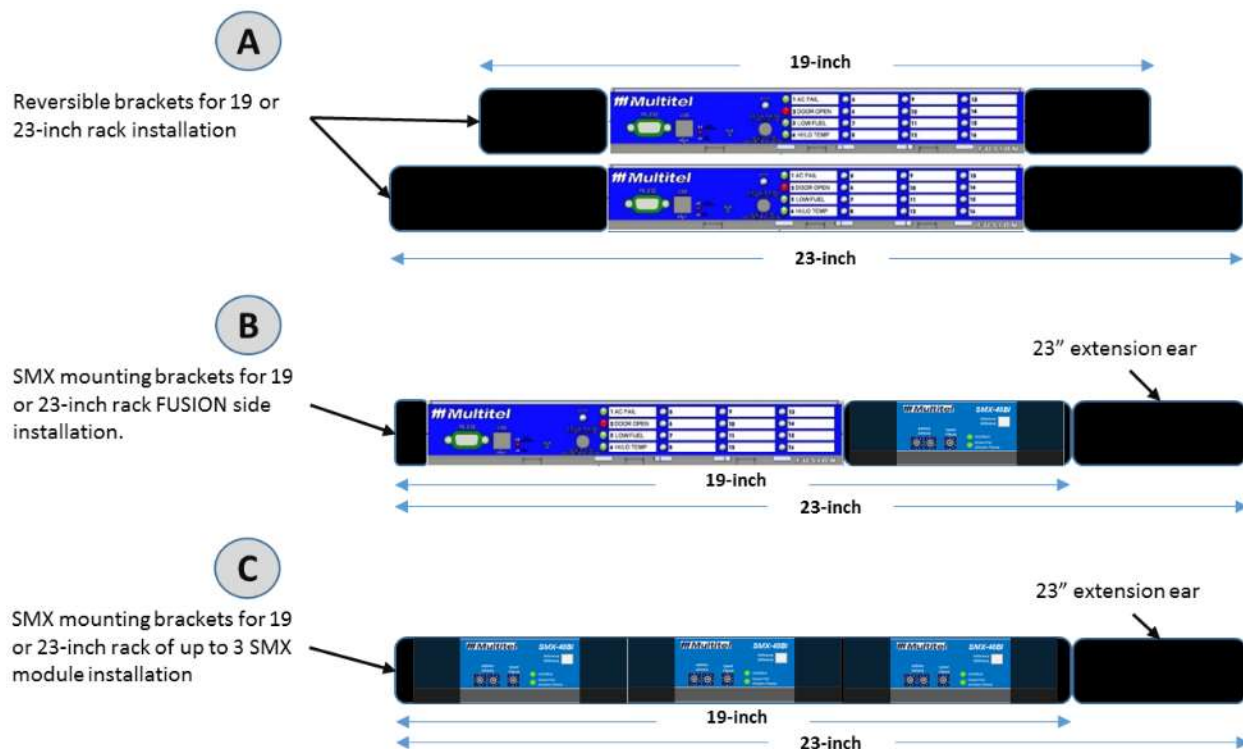
Type	Component	Specifications
MODBUS/RS-485	Width:	5.48 inch (13,92cm)
	Depth:	10.50 inch (26,67cm) with GND stud
	Type:	2 wire RS-485
	Isolation:	1,5kV
	Baud Rate:	Adjustable from 1200 to 115 200 bps

9.1.3 SMX module installation

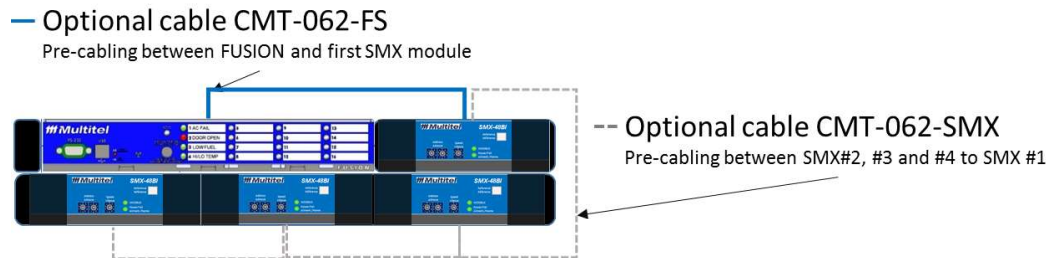
The SMX module is meant for standard telecom 19 or 23-inch rack installation. The B & C illustrations below shows the new SMX module racking options. Illustration A shows the current standard FUSION installation with centered reversible brackets. When ordering B or C, the reversible mounting brackets are not included. For maximum space saving, one SMX module can be installed to the right of the FUSION as illustrated below (See B). The shelf used to support the SMX module also serve the purpose of fixing the FUSION in the rack. This enables the maximum I/O density in a single rack space.

When installing the SMX module, the following B & C options are available:

Figure 11 – FUSION and SMX rack mounting options



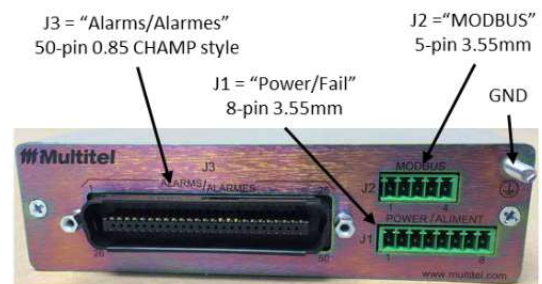
When multiple SMX modules are installed, the K-SMX1U3S shelf can be ordered and can be stacked one on top of each other as there is not restriction for ventilation. For easier maintenance and access to connectors, a K-SMX1UB blank space panel can also be provisioned in order to leave space between stacked SMX modules. Following is an example, all ordered hardware is shipped with both 19 or 23-inch rack configuration. A RS-485 cable for MODBUS connection can be ordered separately CMT-062-FS to reach between FUSION and first SMX module installed next to FUSION. The CMT-062-SMX will enable the reach between the first SMX module up to the fifth module in the shelf. Pre-Power cabling option is not available.



9.1.4 SMX-48BI back panel review

The back panel is where all connections are made. The SMX-48BI offers 3 different plug-in connectors for easy module maintenance or replacement.

- J1 = "POWER/ALIMENT." connector
- J2 = "MODBUS" connector
- J3 = "Alarms/Alarmer" 50-pin Champ Plug style connector

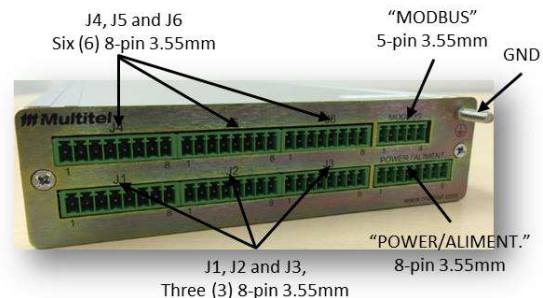


9.1.5 SMX-24AI back panel review

The SMX-24AI offers the following **screw terminal connectors** for easy sensors and transducer connexions and module maintenance.

- J1 = M(x)A1 to M(x)A4 connector
- J2 = M(x)A5 to M(x)A8 connector
- J3 = M(x)A9 to M(x)A12 connector
- J4 = M(x)A13 to M(x)A16 connector
- J5 = M(x)A17 to M(x)A20 connector
- J6 = M(x)A21 to M(x)A24 connector

"POWER/ALIMENT." and "MODBUS" connectors



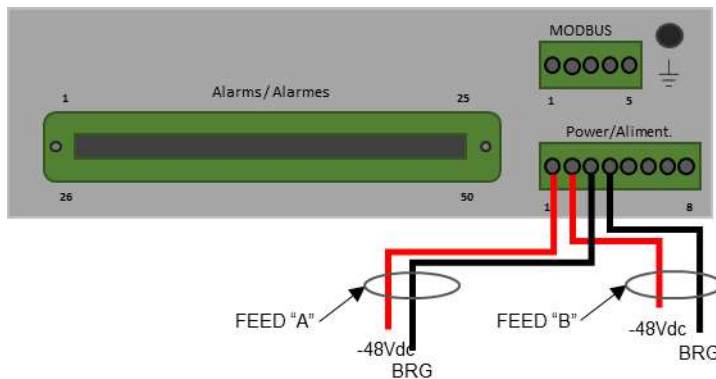
9.1.6 Powering the SMX modules

The SMX module should be feed between -40 to -60Vdc, typically -48Vdc directly to J1 connector labeled "POWER/ALIMENT.". It is recommended to feed with A&B redundant power feed when available from nearby power source. If a redundant power source is not available, consider feeding the single power source to both SMX module's "FEED_A" and "FEED_B" to eliminate the "Loss of FEED_A" or "Loss of FEED_B" SMX system alarm.

When multiple modules are installed together in a rack, each SMX module can be powered individually from as many fuses or circuit breaker as there are SMX module. You may consider also consider to source power from a single fuses or circuit breaker and distribute (daisy chained) the power source to all SMX modules. If doing so, consider 200mA@ 48Vdc / SMX module.

For maximum reliability, power each SMX module to a redundant fuse panel independently. Use #24 to #18 AWG to wire the SMX power source.

Figure 12 – SMX Power input wiring



Power/Aliment. (Back Panel) PIN	Usage
1	BATT_FEED-A
2	BATT_FEED-B
3	BRG_FEED-A
4	BRG_FEED-B
5	FAIL_COMM
6	FAIL_NO
7	FAIL_NC
8	*LG

*The LG (Logic Ground) is used as a single point reference for all the 48 binary input channel. For convenience, the LG is available on the J3 “ALARMS/ALARMES” connector pin 49. Thus J1 pin-8 is wired to J3 pin-49. There is a reversible electronic protection on the LG pin. If ever the LG protection activates, the SMX module will generate a system fault and cause the Power/Fail LED to blink **red** twice.

When both feed are powering the module, the “Power/Fail” LED is solid green. A fault on the power feed will generate blinking on the SMX front panel “Power/Fail” LED.

1. Blinking **orange** once for Feed_A
2. Blinking **orange** twice for Feed_B

The LG, FEED_A or FEED_B faults can be reported back to FUSION using the extra binary input channel named M(x)S1 to M(x)S5. These channels are available in the CONFIG menu for each SMX binary input module. Look at the bottom of the web page.

Mnemonic	Name	State		Occurrence Counter
M4S1	BOOTLOADER	None	DIS	0
M4S2	NO CONFIGURATION	None	DIS	0
M4S3	No FEED A	Enabled	OFF	0
M4S4	No FEED B	Enabled	OFF	2
M4S5	LG Fault	None	DIS	0

For more detailed information on the SMX system faults and LED error codes, consult [chapter 12 Troubleshooting](#).

9.1.7 SMX MODBUS setup

The SMX module has been designed to be networked with the FUSION RTU. However, it can very well be connected to a PC equipped with an EIA-485 interface, building gateways, data loggers or building management systems that supports standard MODBUS RTU. For more information on the MODBUS protocol go to www.modbus.org.

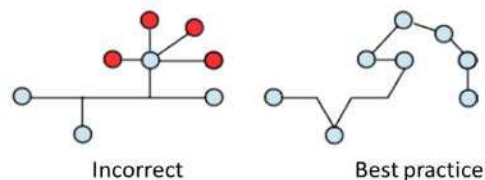
Consider the following best practices when using MODBUS RTU protocol on a RS-485 network.

Some MODBUS Network best practices:

In the event of connecting multiple device on the RS-485 MODBUS Network, weather they are remote of physically installed close to the FUSION, the following best practises should be followed:

1. MODBUS modules should be installed not more than 600ft away from the FUSION.

2. The MODBUS network should be setup as a daisy chain (see side illustration), going from one module to another and not in a star-shape configuration.
3. When modules are installed away from the FUSION with fast communication speed, a termination resistor (120 Ohms) should be used on the last module of the daisy chain network.
4. Always connect the shield (if used) to earth ground and only at one end.

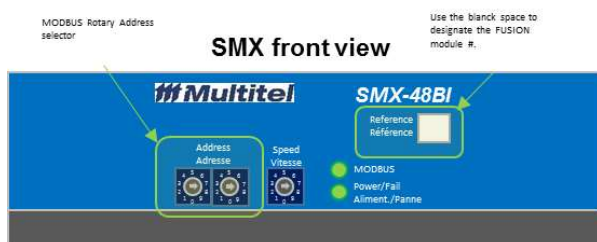


Use the rotary switch labeled “Address/Adresse” to set the address of the module (1 to 99) and set accordingly in the FUSION module configuration.

IMPORTANT NOTICE:



The SMX MODBUS address and the FUSION module reference number may be different, therefore a blank space has been provided on the SMX front display to designate the associated FUSION module number.



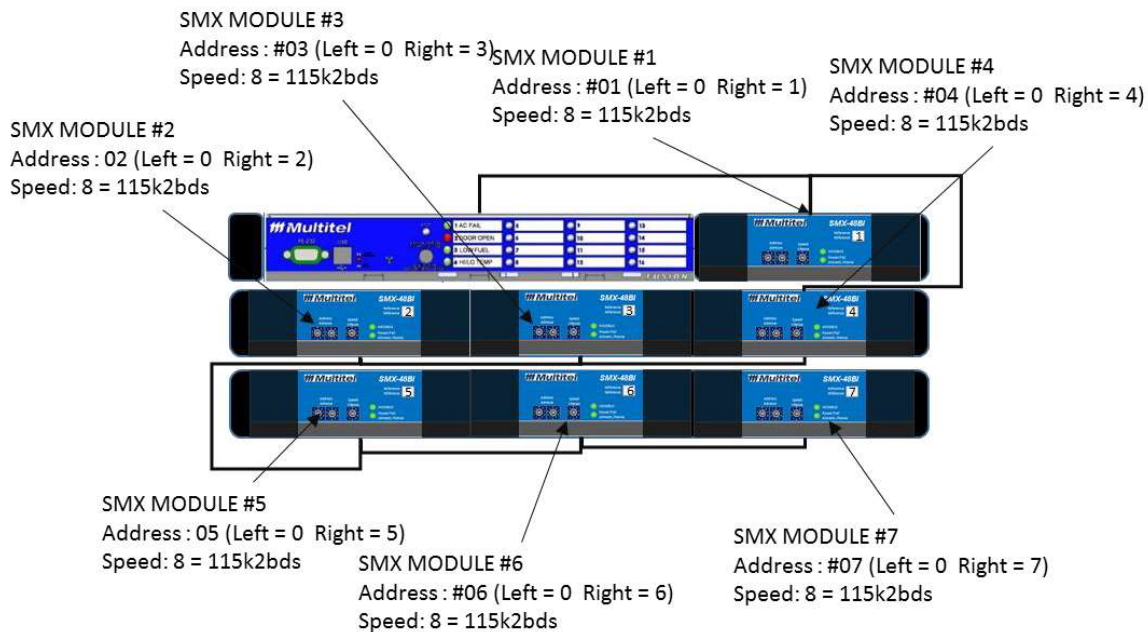
Default Setting		
Rotary Label	Description	Value
Address	Left rotary switch	0
Address	Right rotary switch	1
Speed	Baud Rate	8

The MODBUS communication will not take place if the same SMX MODBUS address is configured in the RS-485 network. After the SMX module address is configured, setup communication speed accordingly by setting Rotary switch labeled “Speed/Vitesse” and position accordingly. By default, the factory SMX communication speed setting is 115,2kbds. Any changes to rotary switches will take effect immediately.

Speed Rotary (front panel)			
Number	Baud rate (kbps)	Number	Baud Rate (kbps)
1	1,2	5	19,2
2	2,4	6	38,4
3	4,8	7	57,6
4	9,6	8	115,2 (default)

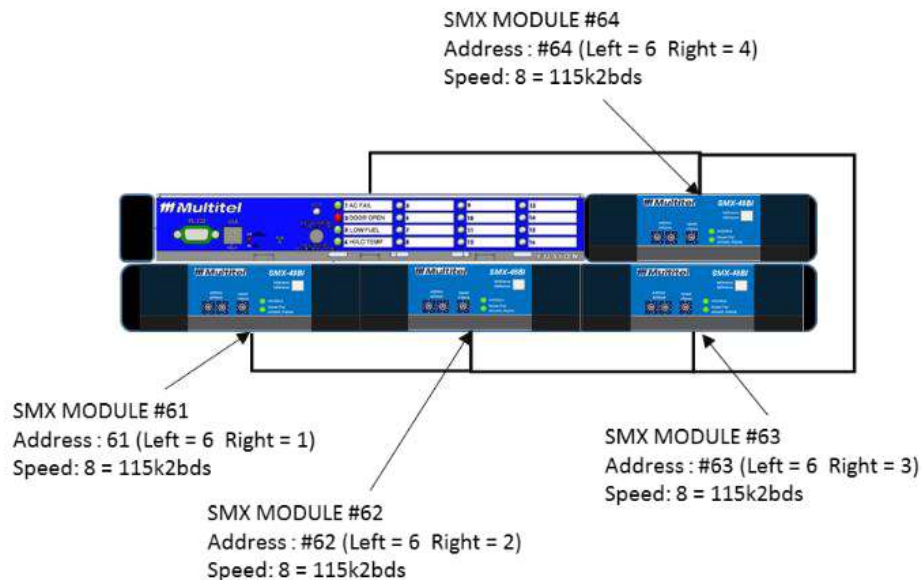
When ordering multiple SMX modules, Multitel will setup the module addressing as per the following

Figure 13 – SMX Typical MODBUS setup



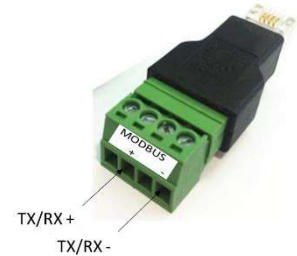
In some instances, FUSION may already be installed with generic MODBUS devices. The devices are most likely configured with #1, #2 address consecutively and setup to communicate at 9600 or 19200 bds. For the SMX MODBUS address configuration, we recommend using the following MODBUS arrangement, see image below. This is not mandatory, it is a suggestion in order to minimize the impact on your FUSION operating parameter configuration. Set the SMX module's communication speed according to the actual MODBUS network.

Figure 14 – SMX Alternative MODBUS setup



The RS-485 connector in this pictures can be used in MODBUS connexions to convert the RJ-12 connector at the back of the FUSION into a crew terminal. The module is available from Multitel, simply ask for the part number: C-7000-MOD

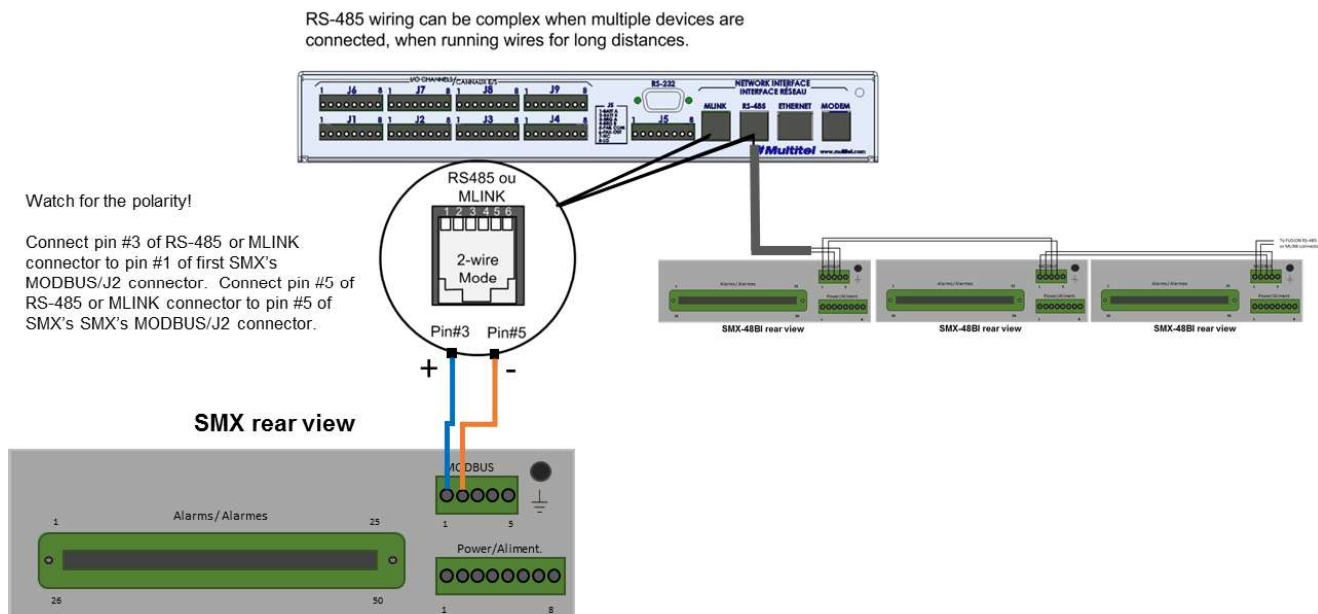
The MODBUS connector has 4 pins; the “TX/RX +” and “TX/RX -” are well indicated on the connector. Use AWG #16 to #26 stranded wires for cabling. Refer to the section [12.8 WIRING MODBUS MODULE](#) for information on the Two-wire MODBUS connection.



9.1.8 SMX MODBUS Wiring

RS-485 wiring can be complex when multiple MODBUS devices are networked together, when running wires for long distances, and when using termination resistors. Be sure to connect the IN-, IN+, terminals accordingly, respect the polarity, otherwise MODBUS communication will not take place. The front display is equipped with LED which provides error code for easier trouble shooting. MODBUS wiring to the FUSION is also discussed in the installation section [11.8](#).

Figure 15 – SMX MODBUS wiring



J2 – MODBUS Connector			
PIN	Usage	Description	
1	IN+	Data Positive side from Master/Slave	
2	IN-	Data Negative side from Mater/Slave	
3	OUT+	Data Positive side to remaining slave devices	
4	OUT-	Data Negative side to remaining slave devices	
5*	GND	Used in noisy environments or long distances	

*The pin #5 labeled “GND” on the MODBUS/J2 connector is normally not used. However, for long distances, you may use shielded twisted-pair cable to prevent communication interference. Connect the shield to earth ground only at one end.

9.1.9 SMX-48BI Alarm Connector (J3) “wiring

The SMX-48BI is equipped with a “Champ” PLUG type 50 pin connector which makes it convenient for alarm termination between a punchdown style block like a wire-wrap, BIX or 66 block. Using a 25 pair Telco Cable (Not provided), the 48 binary inputs of a FUSION can be routed to a block in minutes. This makes it a time saving element when making legacy RTU replacement in existing Telecommunication centers.

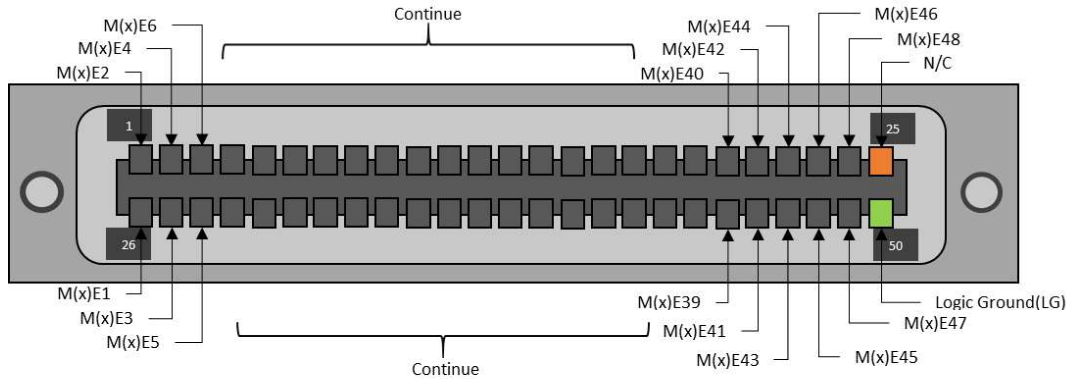


The following table provides the cross reference between the binary input channel mnemonics and the Alarm/Alarms connector’s pins. The default matrix is provided for quick and simple alarm termination to 66 block or wire wrap blocks. For detailed information on binary input operation, see section 4.6.

Table 61 – “ALARM/ALARMS” CONNECTOR PINOUT (J3)

<i>Alarms pin-out for the SMX-48BI</i>			
<i>J3 connector - 50 pin “CHAMP” style – STANDARD ORIENTATION</i>			
<i>PIN</i>	<i>Mnemonic</i>	<i>PIN</i>	<i>Mnemonic</i>
1	M[x]E2	26	M[x]E1
2	M[x]E4	27	M[x]E3
3	M[x]E6	28	M[x]E5
4	M[x]E8	29	M[x]E7
5	M[x]E10	30	M[x]E9
6	M[x]E12	31	M[x]E11
7	M[x]E14	32	M[x]E13
8	M[x]E16	33	M[x]E15
9	M[x]E18	34	M[x]E17
10	M[x]E20	35	M[x]E19
11	M[x]E22	36	M[x]E21
12	M[x]E24	37	M[x]E23
13	M[x]E26	38	M[x]E25
14	M[x]E28	39	M[x]E27
15	M[x]E30	40	M[x]E29
16	M[x]E32	41	M[x]E31
17	M[x]E34	42	M[x]E33
18	M[x]E36	43	M[x]E35
19	M[x]E38	44	M[x]E37
20	M[x]E40	45	M[x]E39
21	M[x]E42	46	M[x]E41
22	M[x]E44	47	M[x]E43
23	M[x]E46	48	M[x]E45
24	M[x]E48	49	M[x]E47
25	Do not used	50	*LG

Figure 16 – SMX-48BI Champ connector pinout

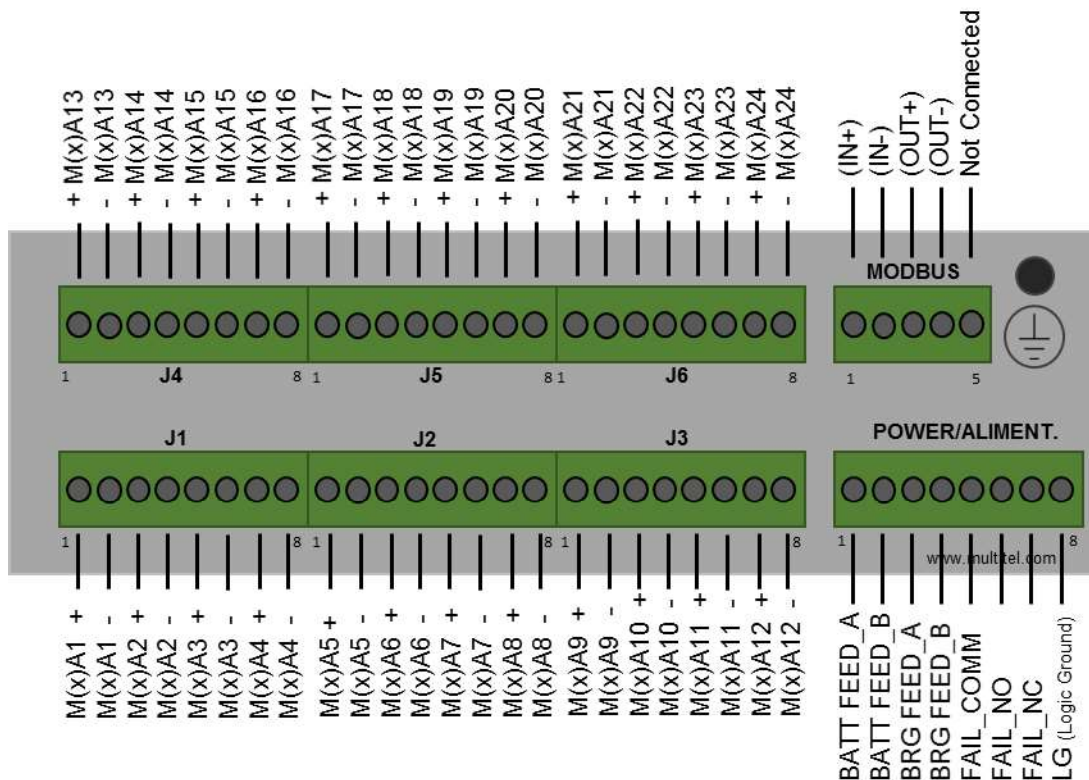


9.1.10 SMX-24AI analog input wiring

The SMX-24AI is equipped with six (6) 8-pin modular screw type terminals which makes it convenient for terminating shunts, CTs and any other probes or sensors. Direct DC voltage up to 65Vdc can be applied directly. Each front end is protected by a automatic resettable electronic device to protect the electronics from voltage overload.

The following table provides the cross reference between the analog input channel mnemonics and the **J1** to **J6** connector's pins. For detailed information on analog input operation, see section [3.5](#).

Figure 17 – SMX-24AI analog input channel connector pinout

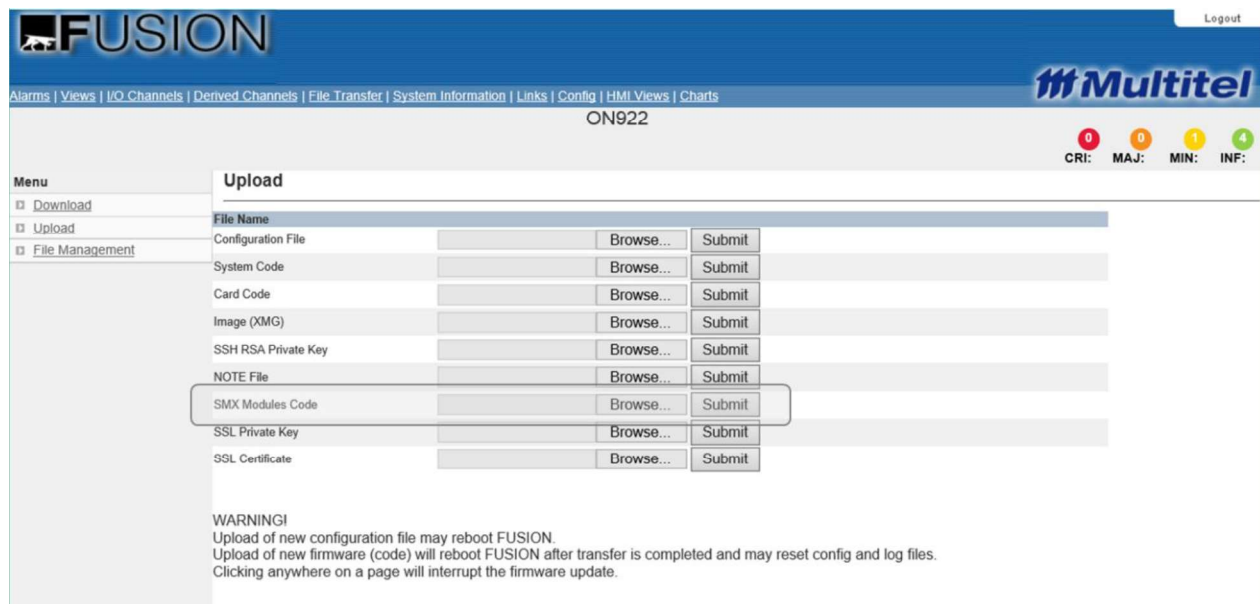


9.1.11 Uploading the SMX module code

The SMX module firmware code has a **.ces** file extension, there is one firmware for the SMX-48BI and one firmware for the SMX-24AI. The file is meant to be uploaded using the FUSION's File Transfer application. One firmware is push to the network of SMX module at a time.

To update an SMX module, the module has to be "enabled" in the module's configuration; in the "disabled" or "none" state, the SMX module cannot be updated. When a new file is submitted, the web page will present a web page with progress bar displaying the status for each SMX module. **DO NOT CLICK ON THE PAGE AS IT WILL CANCEL THE UPGRADE PROCEDURE.** FUSION validates the SMX module type and actual version. FUSION will push the firmware only to those SMX module needing to be upgraded. During the data transfer, a Cyclic Redundancy Check (CRC) on the whole code is performed.

In the case of an upload interruption, before it was completed, the SMX module stays in the BOOTLOADER and waits for a new code. The SMX module is then in fault, the FUSION cannot read the data. When the upgrade is completed and one or few SMX modules reside in the BOOTLOADER, retry to submit the firmware again.



FUSION Logout

Alarms | Views | I/O Channels | Derived Channels | File Transfer | System Information | Links | Config | HMI Views | Charts

ON922

CRI: 0 MAJ: 0 MIN: 1 INF: 4

Menu

- Download
- Upload
- File Management

Upload

File Name		
Configuration File	Browse...	Submit
System Code	Browse...	Submit
Card Code	Browse...	Submit
Image (XMG)	Browse...	Submit
SSH RSA Private Key	Browse...	Submit
NOTE File	Browse...	Submit
SMX Modules Code	Browse...	Submit
SSL Private Key	Browse...	Submit
SSL Certificate	Browse...	Submit

WARNING!
 Upload of new configuration file may reboot FUSION.
 Upload of new firmware (code) will reboot FUSION after transfer is completed and may reset config and log files.
 Clicking anywhere on a page will interrupt the firmware update.



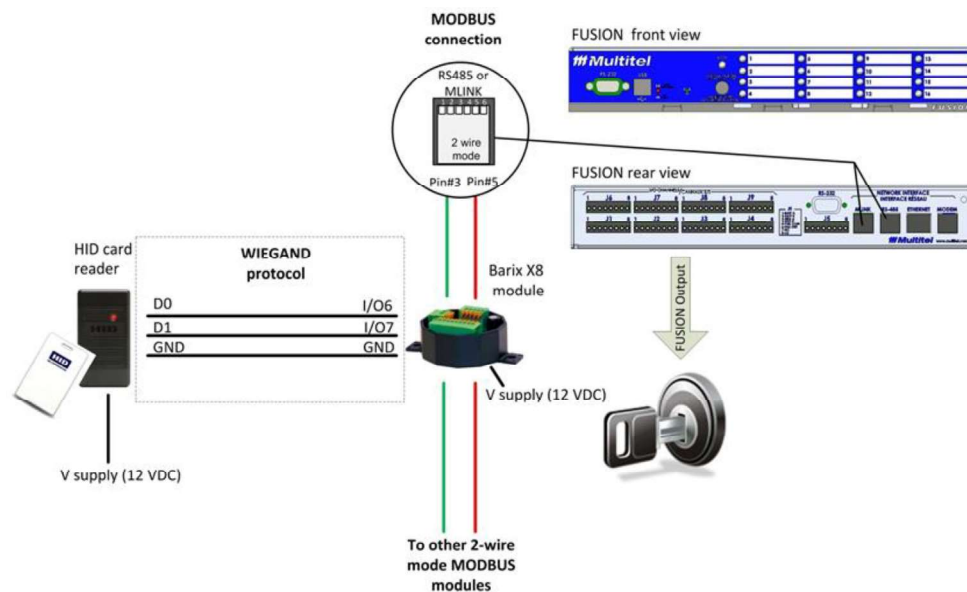
Note that while uploading the card code, the Internet Explorer V8 does not display the page correctly. However, Internet Explorer V11 and Chrome are displaying the page correctly.

9.2 DOOR ACCESS CONTROL (4)

9.2.1 System description

The FUSION has the ability to control the entry to a telecom site or the access to specific rooms within a telecom site. FUSION interfaces with existing proximity card readers as long as they operate on the standard Weigand 26-bit security protocol. FUSION can interface with up to 4 different proximity card readers, thus 4 doors, 2 doors if a card reader is used to enter and exit the building.

Figure 18 - Schema showing the use of one (1) HID card reader



When planning a door access control strategy, consider using the following products. However, we recommend contacting Multitel Technical Services first before you plan your equipment purchase in order to review in details your requirements and solution design as the door control access application requires some specific programming, configuration and wiring. Contact us at 1-888-685-8483 (US & Canada) and (418) 847-2255 (International).

HID proximity card reader

The HID proximity card reader used by Multitel is the ProxPoint® Plus 6005. The device is connected to a pre-configured BARIX X8 module according to the Wiegand protocol wiring description. The installation manual is provided with the system. The red/green LED and beeper are to be connected by the customer. The HID proximity card reader and BARIX X8 both operate on 12Vdc power supply to be supplied externally.

Although WIEGAND protocol allows 80 bits, FUSION is pre-configured/programmed to card codes with a maximum of 26 bits.

BARIX X8 module

The BARIX X8 module is used to convert the 26-bit Weigand output signal from the HID proximity card reader to a standard MODBUS RTU protocol in turned easily interfaced with FUSION. The X8 should be provisioned at Multitel in order to pre-configure the MODBUS communication link and MODBUS register accordingly. The X8 instruction manual is provided with the system. The

X8 module needs to be software programmed for address assignment and to set the parity to none (FUSION requirement). Multitel's technicians perform this task and validate operation with your FUSION unit before it ships. Once the X8 is programmed, the settings are maintained in the module's flash memory. However, resetting the device will return to the setting to default values and the X8 would then need to be reconfigured.

9.2.2 HID card reader setup into FUSION

RFID Card/Tags registration within FUSION

FUSION has one "ACC" configuration file acting as a database for all HID card code numbers, owner's contact information allowed for the 4 doors or access points controlled by the system. The file called **ACC Configuration file** is located in **File Transfer** from the HTTP(S) Interface top menu and **Download** on the left submenu. Only users with supervisor access can see and download this file to add or remove accesses related to HID card code numbers. The file is available in FUSION, even when empty. The following example of an ACC configuration file explains in more details the main components of the file.

	A	B	C		H	I	J
1	REM	ACCESS DEFINITION FILE					
2	REM						
3	REM	FUSION					
4	REM	Software Ver 4.50A06					
5	ACCG	METRONET HID DEMO					
6		Date: 05/02/2013 13:02:54					
7		Time: 13/04/18 14:04:34					
9	SNAME	METRONET HID DEMO					
10	REM						
11	ACCG	NM	Group 1	SCHE	sch1		
12	ACC1	FNAME	Leo	LNAME	Schmitt	E_ID	555--45534 C_ID 6966818
13	ACC2	FNAME	John	LNAME	Edwards	E_ID	556--45533 C_ID 6966817
14	ACCG	NM	Group2	SCHE	sch2		
15	ACC3	FNAME	Kevin	LNAME	Kenneday	E_ID	557--924797 C_ID 39743
16	ACC4	FNAME	Eric	LNAME	Warren	E_ID	558--1251154 C_ID 59483
17	ACC6	FNAME	Laurent	LNAME	Powell	E_ID	560--924838 C_ID 91989
18	ACCG	NM	contractor	SCHE	tsp1		
19	ACC5	FNAME	Sam	LNAME	Johnson	E_ID	559--1251143 C_ID 118748
20							

In this file, accesses are controlled using the card code numbers and also a schedule derived channel, SCH[x], to allow access within specified working hours (see section [Error! Reference source not found.](#) for details on scheduling). This ACC Configuration file controls all four (4) access points; so if a card code number has been given access to one door, it will also have access to the 3 other doors if they are configured in the system.

Up to 128 accesses are allowed in the system, they are named ACC[x] in the ACC Configuration file. Once configured in the ACC Configuration file, the ACC[x] channels are displayed on the HTTP(S) interface under the **Derived channels** top menu and **Access** on the left submenu.

Procedure for giving access to a new HID card user:

1. The new user presents the HID card to one of the four (4) card readers for the first time.
2. The system does not allow the user to enter but the card code number is now logged in the History File via the AINT[x] intrusion alarm signal (where x = 1 to 4 depending which card reader has been used) which is a FUSION internal alarm.
3. The user in charge of allowing accesses has to download and edit the ACC Configuration file (only users with supervisor access have this right). The user must then write the new user HID card code number together with the user information under the appropriate schedule section (see section [Error! Reference source not found.](#) for details on scheduling). Temporary workers or contractors can have their own access using a dedicated TSP channel instead of a schedule (ex: two days access permission).
4. Once the ACC Configuration file has been saved, it has to be uploaded using the **Configuration File** section of the **Upload** page, replacing the previous file.
5. The new user should now have access with its HID card.

Note: The AINT[x] intrusion alarm will always show the code number of the last unidentified HID card presented to the HID card reader. That means that it is possible to have four (4) intrusion alarm signals in the History file, each one corresponding to one of the four (4) doors or access points. The intrusion alarm AINT[x], logged in the History file, will show the last unidentified code number read from the corresponding card reader everywhere in the file, overwriting the previous intrusion attempt card code number of the specific reader.

Channel	Name	Value	Occurrence	Date Time
LED14	Intrusion Attempt	NA	0	13-05-09 9:56
G2	Intrusion Attempt	NA	0	13-05-09 9:56
AINT1		59483 ON	6	13-05-09 9:56
LED13	Door Strike on	OFF	16	13-05-09 9:48
F1O1	Site Door Entrance	OFF	16	13-05-09 9:48
ACTL1	Main Entrance Door	OFF	16	13-05-09 9:48
LED13	Door Strike on	ON	16	13-05-09 9:48
F1O1	Site Door Entrance	ON	16	13-05-09 9:48
ACTL1	Main Entrance Door	ON	16	13-05-09 9:48
ACC3	Kevin Kenneday	OFF	4	13-05-09 9:48
ACC3	Kevin Kenneday	ON	4	13-05-09 9:48
LED13	Door Strike on	OFF	15	13-05-09 9:48
F1O1	Site Door Entrance	OFF	15	13-05-09 9:48
ACTL1	Main Entrance Door	OFF	15	13-05-09 9:48
LED13	Door Strike on	ON	15	13-05-09 9:48
F1O1	Site Door Entrance	ON	15	13-05-09 9:48

9.2.3 Access Control Channels

FUSION provides four (4) Access Control Channels. Each of these channels is associated with an proximity card reader installation comprised of an HID card reader, the BARIX X8 I/F module, door contact and/or locking mechanism). The ACTL[x] channel mnemonic is reference to one of FUSION's binary output's triggering source to control the door strike or locking mechanism associated with it.

These channels are displayed on the HTTP(S) interface under the **Derived channels** menu. Each channel is individually programmable. Click on **Config** on the top menu (Supervisor access only) and then choose **Access Control** on the left submenu. Click on the **ACTL[x]** to be configured.

Table 62 - ACTL[x] parameters configuration

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each ACTL channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Not Logged
Slave ID	The slave ID is the identification number of the BARIX X8 module (Modbus module). The module's ID has been already programmed by Multitel's technicians and should be identified on the device. Select: between 1 and 255	1

Parameters	Description	Default Value
Port	Port selection to which the module will be connected. If you already have a Modbus RTU connection on one of these ports, the BARIX X8 module can be incorporated in the 2-wire RS-485 subnet Modbus connection. Select: RS-485 Back Port or MLINK Port	RS-485 Back Port
Door activation time	Pre-set time allowed for the door to stay unlocked once it has been activated. Select: 1 to 30 seconds	3
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	No

Example of an ACTL[x] channel configuration

The screenshot shows the FUSION web interface. On the left is a menu with options like Access Control, Arithmetic, Audible Alarm, Binary Manual, Callout, Chronometer, Communication Ports, Constant, Daily Statistics Channel List, Duty Cycle/Average, and EMAIL Protocol. The main area displays the configuration for the ACTL1 channel. The configuration table is as follows:

Parameter	Value
The channel state is	Enabled
The name is	Main entrance door
The alarm level is	Minor
The slave ID is	255
The port is	RS485 Back Port
The door activation time is	3
The occurrence number is	0

Two callout boxes are present:

- One pointing to the channel name: "This channel is used to control the main entrance door via FUSION's output."
- Another pointing to the door activation time: "When ACTL1 is activated, the door will be unlocked for 3"

9.2.4 Schedule Channels

In order to give or restrain access according to a specific schedule, a **SCH[x]** derived channel is used together with the HID card code number for validation in the ACC Configuration file.

FUSION offers 32 Scheduling channels. Each of these channels can be activated only once within a 24 hour time frame.

The **Schedule** channels are displayed on the HTTP(S) interface under the **Derived channels** menu. Each channel is individually programmable. Click on **Config** on the top menu (Supervisor access only) and then choose **Schedule** on the left submenu. Click on the **SCH[x]** to be configured.

Table 63 - SCH[x] parameters configuration

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected it will not appear in the configuration file.	None
Name	Channel identification. (Up to 40 characters)	Not Programmed
Alarm Level	Each SCH[x] channel can be associated with an alarm level type: Not Logged, Informational Minor, Major or Critical.	Info

Parameters	Description	Default Value
Schedule parameters	Setting used to allow access in one week interval. There are two formats accepted for scheduling. The first one: Day of the week separated by "." then "," start time end time. (Ex: Monday. Friday ,8:00 17:00) The second format is: writing the numbers corresponding to the day of the week separated by "." (where 1= Sunday, 7=Saturday) then "," start time end time (ex: 2.6,8:00 17:00). These two examples correspond to the same schedule: Monday to Friday from 8:00 to 17:00.	Not Programmed
Reset Occurrence counter	The occurrence counter is used to tally the number of valid state changes. Permission to reset occurrence counter: Yes or No	No

Example of a programmed schedule on the HTTP(S) interface:

Menu

- Access Control
- Arithmetic
- Audible Alarm
- Binary Manual
- Callout
- Chronometer
- Communication Ports
- Constant
- Daily Statistics Channel

Schedule

Property	Value
SCR1	Enabled
The channel state is	group1
The name is	Info
The alarm level is	Monday,08:00 17:00
	Tuesday,08:00 17:00
	Wednesday,08:00 17:00
	Thursday,08:00 17:00
	Friday,08:00 17:00
	1

This channel is used in the ACC Configuration file to restrain access to specific hours within the day.

9.3 REMOTE MODBUS DISPLAY (RMD)

As an accessory to the FUSION, this Remote Modbus Display can be used to remotely show critical parameters such as environmental conditions, power and cooling capacity ratios, plant/battery voltages and load currents of DC power systems.

The module can be placed at a strategic location and allow maintenance staff to visualize up to 4 configurable I/O channels in real time.

The module is 48Vdc powered, Modbus RTU ready and can be installed up to 600ft/180m away from the FUSION unit. The Modbus communication cable has to be connected as described in section 12.8 Wiring Modbus Module. The Remote Modbus Display is designed to be installed on the wall or on a flat surface as there are no mounting brackets provided for standard 19 or 23 inches telecommunication racks.



Remote Modbus Display dimensions (HxDxW):
31,5mm x 63,5mm x 138 mm
1.25 in x 2.5 in x 5.44 in

Refer to the Remote Modbus display user manual for additional information on the device (installation, configuration, specifications and detailed features). Ordering information for the RMD is the following: M-7048-VFD: 20 X 4 Modbus VFD Display;48V;Modbus.

For configuration, click on **Config** on the top menu (Supervisor access only) and then choose **Remote Display** on the left submenu. Click Edit to configure the **DISP** parameters.

Table 64 - DISP Configuration Parameters

Parameters	Description	Default Value
Channel state	Disabled, Enabled or None. When none is selected, the unit will not appear in the configuration file.	None
Slave ID	Slave ID is the identification number of the Modbus Display module. Select: between 1 and 255	1
Port	Port Selection to which the module will be connected. Select: RS-485 Back Port or MLINK Port	RS-485 Back Port
Backlight control	This parameter allows enabling or disabling the Modbus Display backlight control. Select: Disabled or Enabled	Enabled
Delay before turning off backlight	Enter the delay, in minutes, before turning off the backlight. Select between 5 and 255 minutes.	15 minutes
Channel to display on line 1	The channel to be sent to the module for line 1 is configured in this parameter. Type H for help specific to the channel selection. If the value exceeds 10 characters, it will automatically be divided by 1000 and a small "k" for kilo will be added in front of the unit associated to the channel.	Not Programmed
Text to display on line 1	Enter the text related to the channel selected for line 1 (max of 11 characters)	
Channel to display on line 2	The channel to be sent to the module for line 2 is configured in this parameter. Type H for help specific to the channel selection. If the value exceeds 10 characters, it will automatically be divided by 1000 and a small "k" for kilo will be added in front of the unit associated to the channel.	Not Programmed
Text to display on line 2	Enter the text related to the channel selected for line 2 (max of 11 characters)	

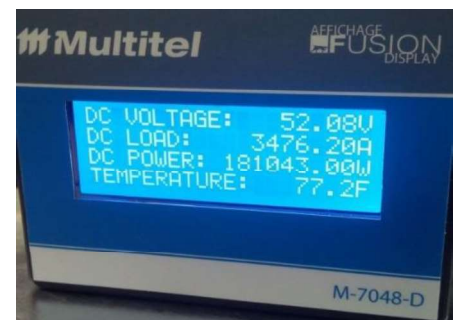
Parameters	Description	Default Value
Channel to display on line 3	The channel to be sent to the module for line 3 is configured in this parameter. Type H for help specific to the channel selection. If the value exceeds 10 characters, it will automatically be divided by 1000 and a small "k" for kilo will be added in front of the unit associated to the channel.	Not Programmed
Text to display on line 3	Enter the text related to the channel selected for line 3 (max of 11 characters)	
Channel to display on line 4	The channel to be sent to the module for line 4 is configured in this parameter. Type H for help specific to the channel selection. If the value exceeds 10 characters, it will automatically be divided by 1000 and a small "k" for kilo will be added in front of the unit associated to the channel.	Not Programmed
Text to display on line 4	Enter the text related to the channel selected for line 4 (max of 11 characters)	

A Binary Fail signal, **BFDISP**, is activated when the configured Modbus Display is unavailable.

9.3.1 Application example



In this example, the four (4) lines configured in FUSION are displayed on the Remote Module Display. The units are the ones configured in the channel linked to the selected lines.



10 COMMUNICATION

This section contains information regarding all communication aspects: connector definition, communication configuration, application examples and communication protocols. All serial communication ports and the internal modem port can be disabled by the user with supervisor access level by changing a specific configuration parameter for each of these ports.

Telnet and SSH protocols can also be deactivated by a user with supervisor access by setting a specific parameter in the "General System Parameters" function (see section 4.3).

10.1 FRONT RS-232 AND USB PORT

Since most recent laptops are no longer provided with serial ports FUSION is now equipped with both RS-232 and USB ports.

RS-232 port:

The RS-232 serial port located on the front panel card is used mainly for local access. It may also be used for alarm re-transmission messages for a terminal server. The DB-9 female connector is connected to a laptop computer with a direct cable. This port is concurrent with the USB port it must be noted that they cannot be used simultaneously. The RS-232 port may also be configured to interface with external modems, pads and terminal servers.

Table 65 - CRAFT port RS-232 connector definition (DB-9F)

PIN	Signal Direction	Description
1	In	DCD - Data Carrier Detect
2	Out	TXD - Transmit data
3	In	RXD - Receive data
4	In	DSR - Data Set Ready
5	N/A	Signal Ground
6	Out	DTR - Data Terminal Ready
7	In	CTS - Clear to Send
8	Out	RTS - Request to Send
9	In	RI - Ring Indicator

USB port:

The USB port located on the front panel card is used mainly for a local access as an alternative to the RS-232 serial port. . The port requires a USB Cable Type A/B to connect to a laptop and is compatible with both USB 1.0 and 2.0 standards. The USB port may require a specific driver to operate. The port has been tested with various Microsoft™ OS and from Microsoft™ Vista onward should not require the driver to be installed. If a driver is required it is available on the FUSION CD-ROM, on the Multitel HTTP(S) site www.multitel.com, or can be obtained from Multitel Technical Support Staff at 418.847.2255. Once the driver is installed a new COM port will appear in the list of available communication ports on the laptop in use.

1. Select this port.
2. Set the speed to 115200 baud.
3. Press the Enter key 3 times.

The header and user login will be displayed.

Do not hesitate to communicate with the Multitel customer service department if there are any difficulties in setting up the USB driver.

Table 66 - CRAFT port USB Type B connector definition (USB type B)

PIN	Signal Direction	Description
1	In	VBUS +5Vdc
2	Out	D “-” Negative Data
3	In	D “+” Positive Data
4	Out	Signal Ground



Note that both RS-232 and USB ports cannot be operated simultaneously. It is preferable to disconnect or terminate the session before removing the USB cable as it may temporarily freeze the USB port of the Laptop computer.

The laptop must run commercial communication software such as Microsoft Hyperterminal™ or Procomm Plus™. When the laptop is properly connected to the FUSION USB port an additional (COM“x”) port will appear from the available COM port selection. Select this port, set speed to 115200 baud and then you will connect to FUSION.

10.1.1 Port configuration

RS-232/USB communication port configuration is displayed under the **System Information** top menu, simply click on **Front RS-232/USB** on the left submenu and the port configuration is displayed.

To configure the RS-232/USB communication port click on **Config** on the top menu (Supervisor access only) and then choose **Communication ports** on the left submenu. Click on **COMRS232**.

Table 67 - RS-232/USB Port Configuration Parameters

Parameters	Description	Default Value
Protocol	Protocol to be configured at the RS-232 and USB ports. Remember that these two ports cannot be used simultaneously. This port can be disabled by selecting "NONE". Select: Terminal , ISNMS or NONE or Port Forwarding . (The ISNMS protocol is a proprietary protocol used for a particular customer)	Terminal
Baud rate	Select: 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200.	115200
Flow control	Select: None or Hardware. Flow control is achieved using RTS/CTS and DTR/DSR handshaking	None
Device	When there is no modem connected, the choice should be None. Select: None or Modem	None

10.2 REAR RS-232 PORT

This serial communication port is located on the back panel chassis on a DB-9 female connector designated "RS-232". The port is configured as a Data Terminal Equipment (DTE) and is used to manage External Dialup Modem, X.25 Network PAD or interface intelligent systems such as Generator Controller, UPS, HVAC system or any other systems equipped with a RS-232 serial port and an ASCII command-line interface.

Multitel suggests a rack mounted and certified 56kbps external modem powered by 48 volts.

Table 68 - Rear RS-232 connector definition (DB-9F)

PIN	Signal Direction	Description
1	In	DCD - Data Carrier Detect
2	In	RXD - Receive data
3	Out	TXD - Transmit data
4	Out	DTR - Data Terminal Ready
5	N/A	Signal Ground
6	In	DSR - Data Set Ready.
7	Out	RTS - Request to Send
8	In	CTS - Clear To Send
9	In	RI - Ring Indicator.

10.2.1 RS-232 REAR PORT CONFIGURATION

This RS-232 port configuration process is used to configure the port so that it can originate and receive from the external modem. The external will modem automatically adjust to the caller's baud rate.

RS-232 rear communication port configuration is displayed under the **System Information** main menu, simply click on **Rear RS-232** on the left submenu and the port configuration is displayed. To configure the RS-232 rear communication port click on **Config** on the top menu (Supervisor access only) and then choose **Communication ports** on the left submenu. Click on **COMPORT**

Table 69 - RS-232 rear Port Configuration Parameters

Parameters	Description	Default Value
Protocol	Protocol to be configured at the RS-232 rear port. This port can be disabled by selecting "NONE". Select: Terminal , ISNMS , NONE or Port Forwarding . (The ISNMS protocol is a proprietary protocol used for a particular customer)	Terminal
Baud rate	Select: 300, 1200, 2400, 4800, 9600, 19 200, 38 400, 57 600 or 115200.	115200
Flow control	Select: None or Hardware. Flow control is achieved using RTS/CTS and DTR/DSR handshaking	None
Device	When there is no modem connected, the choice should be None. Select: None or Modem	Modem
Modem configuration string	This parameter is available for configuration only when a Modem has been selected as the Device parameter. Certain types of modems installed on personal computers may require some initialisation parameters to be setup (Hayes command string of characters) in order to obtain a reliable modem connection.	
Number of rings before answering	This parameter is available for configuration only when a Modem has been selected as the Device parameter. Select: 1 to 8	3

10.2.2 External modem connection

The back panel RS-232 serial port is designed to support an external modem for extra remote connectivity. The optional external modem offered by Multitel is 48 volt supplied and is rack-mounted. Default values have been factory configured to meet the most popular Hayes-compatible modems.

10.2.3 Pass Through (HUB command)

The Pass through feature provides the means to remotely access intelligent peripherals equipped with a serial port and ASCII user interface. We suggest using the RS-232 rear port in order to maintain local access via the front RS-232 front serial port. E.g. Stand-by generator controller, intelligent power plant controller, rectifier network, or UPS controller. All of these peripheral systems must be equipped with a serial port and ASCII user interface with a baud rate of 300 to 115,200.

The cable used to interconnect a peripheral must be a NULL MODEM cable when the peripheral serial port is configured as a DTE; or a direct cable when the port is configured as a DCE (Data Circuit-terminating Equipment). Connect the cable and check the operation using the "HUB" command. Type the command "BYE" in upper case letters to return to the user interface.

Remote access to the stand-by generator over the Public Switch Telephone Network (PSTN) is also possible using the following process:

1. Refer to the RS-232 table to select the appropriate cable type.
2. Use the proper cable to connect the RS-232 ports on the FUSION and peripheral equipment.
3. Adjust the FUSION and peripheral equipment baud rate (2400 baud recommended).
4. Adjust the communication protocol to 8N1 and the baud rate (2400 baud recommended).
5. Dial the FUSION phone number, establish the communication and at the prompt (>>>), type the "HUB" command.
6. Select the RS-232 port. The generator greeting message is displayed.
7. Use the generator command set to access the required information.
8. When finished type "BYE" to terminate the host connection.

HUB Command Example in Telnet

```
>HUB (Selected port is not available)
HUB
0 - RS232/USB Frontal port (Craft Port) not available
1 - RS232 Rear port not available
2 - Internal MODEM available
```

Choose an item :0

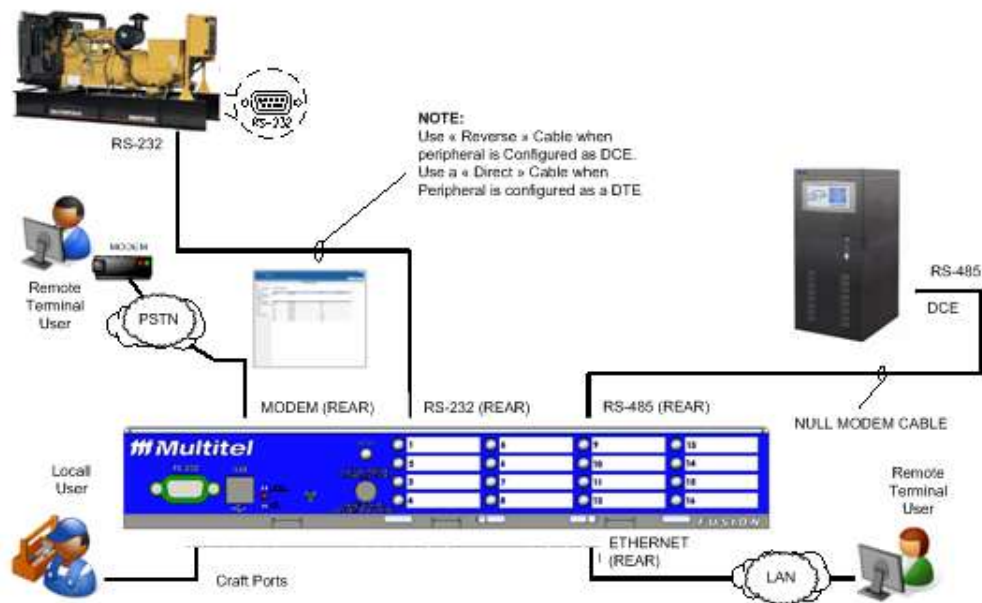
Unable to establish HUB.

```
>HUB (Selected port is available)
HUB
0 - RS232/USB Frontal port (Craft Port) not available
1 - RS232 Rear port not available
2 - Internal MODEM available
```

Choose an item :2

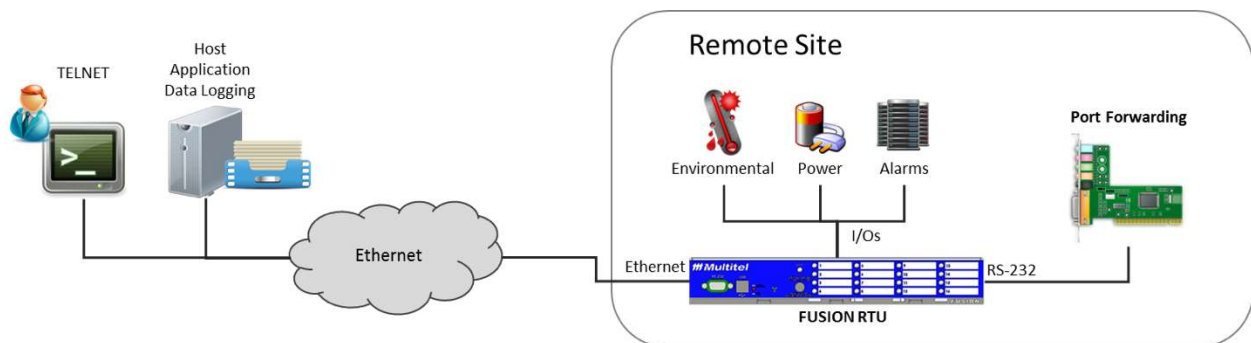
Wait 1 second and type BYE to exit hub mode

Figure 19 – Pass through peripheral intelligent connections (HUB command)



10.2.4 Port Forwarding Protocol

Port Forwarding or port mapping is a protocol supported by the FUSION which enables the FUSION to emulate a basic ROUTER port forwarding functionality. Thus, a user or host application/service can be redirect to any FUSION serial port (Except the MLink and MODEM port) by Telnetting the FUSION's IP and pre-configured port number.



This eliminates the need to provision and install a router; it also eliminates establishing routing tables. The Port Forwarding enable does not support the login sequence, meaning a direct access to the serial port is provided without ever asking for user name and password.

We suggest using the **rear** RS-232 port in order to maintain local access via the front RS-232. Go to the desired serial port and select the Port Forwarding protocol, select the communication speed between the FUSION and the end-device. The flow control should be set to None and same for the Device type. The TCP port number associated to the Port Forwarding protocol is configurable between 1 to 65534. Attention, do not configure or use 22, 23, 80, 161, 514, 443, and 2000 and other standard port number as conflict may arise. The port forwarding protocol is not supported on the MLink and Modem Port.

The cable used to interconnect a peripheral must be a NULL MODEM cable when the peripheral serial port is configured as a DTE; or a direct cable when the port is configured as a DCE (Data Circuit-terminating

Equipment). Connect the cable and check the operation using the “HUB” command. Type the command “BYE” in upper case letters to return to the user interface.

TCP keepalive is supported by the FUSION and transparent to the user, it can be used by the host computer to verify that the FUSION at the remote end of the connection is still available.

Port Forwarding configuration example in HTTP

Enter protocol	Value	
Enter baudrate (0=300, 1=1200, 2=2400, 3=4800, 4=9600, 5=19200, 6=38400, 7=57600 or 8=115200)	115200	<input type="text"/>
Enter flow control (0=None, 1=Hardware)	None	<input type="text"/>
Enter device (0=None, 1=Modem)	None	<input type="text"/>
Enter port forwarding TCP port	65534	<input type="text"/>

10.3 REAR MLINK (RS-485) AND RS-485 PORTS:

FUSION provides two (2) standard EIA-485 communication ports which are located on the back panel. One port is named “MLINK” and the other “RS-485”. Both ports are independent, they can each network 32 MODBUS modules or 15 intelligent I/O cards for a grant total of 64 MODBUS modules or 30 intelligent I/O cards. Since MODBUS modules and Intelligent I/O card do not operate on the same protocol, it is not possible to mix them on a same port. However the MLINK can be used to network I/O cards and the RS-485 to network MODBUS modules as demonstrated below.

Table 70 - Connection possibilities between MLINK and RS-485

Hardware to be connected	MLINK Port	RS-485 Port
No Expansion shelf unit AND 1 to up to 32 MODBUS module(s)	Module(s) 1 to up to 32 (MODBUS RTU protocol) The modules may be split between the two ports	Module(s) 1 to up to 32 (MODBUS RTU protocol) The modules may be split between the two ports
1 to 3 Expansion shelf units with a maximum of 15 I/O card AND No MODBUS module	Expansion shelves for I/O cards 1 to 15 (MLINK protocol)	Not used (may be used as terminal)
1 to 3 Expansion shelf units with a maximum of 15 I/O card AND 1 to up to 32 MODBUS module(s)	Expansion shelves for I/O cards 1 to up to 15 (MLINK protocol)	1 to up to 32 MODBUS modules (MODBUS RTU protocol)
More than 3 Expansion shelf units with a maximum of 30 I/O cards AND No MODBUS module	Expansion shelves for I/O cards 1 to 15 (MLINK protocol)	Expansion shelves for I/O cards 16 to up to 30 (MLINK protocol)

Hardware to be connected	MLINK Port	RS-485 Port
Up to 6 Expansion shelf units with a maximum of 30 I/O cards AND 1 to up to 32 MODBUS module(s)	Configuration not possible	Configuration not possible
No Expansion shelf unit No MODBUS module	Free	Free (may be used as terminal)

Each MODBUS Module on the MODBUS RTU communication bus is allocated a unique address. In FUSION, each one of these devices is configured as a MODULE. For more information on how to configure modules, see section 4.8 SMX and Generic MODBUS MODULES (64).

MLINK connector:

The EIA-485 labelled “MLINK” communication port can either be used to network up to 15 Expansion Shelves’ I/O cards or to connect a maximum of 32 MODBUS modules (e.g. Energy meter, generator controller) using the MODBUS RTU protocol.

More information on the MODBUS module configuration can be found in section 4.8 SMX and Generic MODBUS MODULES (64).

Table 71 - MLINK connector definition (RJ-12)

PIN	Signal Direction	Description
1	N/A	Signal Ground.
2	In	RX “-” Receive Data-Negative.
3	Out	TX “+” Transmit Data-Positive. (Used for MODBUS)
4	In	RX “+” Receive Data-Positive.
5	Out	TX “-” Transmit Data-Negative. (Used for MODBUS)
6	Not used	Not Used

RS-485 connector:

Another EIA-485 serial communication port is available on the FUSION back panel through a RJ-12C connector type designated “RS-485”. The rear RS-485 port can be configured as a general usage port to interface with up to 32 MODBUS modules. However, it can also be utilized to network additional Expansion Shelf(s) using the Multitel’s MLINK protocol. Configuring the rear RS-485 port as ‘MLINK’ (Multitel acquisition bus) enables acquisition cards 16 to 30 to be interfaced.

Each I/O card installed on the acquisition bus must occupy a unique slot position within the Expansion Shelf. NB: only one card on the MLINK acquisition bus may occupy position ‘16’.

Table 72 - RS-485 connector definition (RJ-12C)

PIN	Signal Direction	Description
1	N/A	Signal Ground.
2	In	RX “-” Receive Data-Negative.
3	Out	TX “+” Transmit Data-Positive. (Used for MODBUS)
4	In	RX “+” Receive Data-Positive.
5	Out	RX “-” Receive Data-Negative. (Used for MODBUS)
6	Not used	Not Used

IMPORTANT:

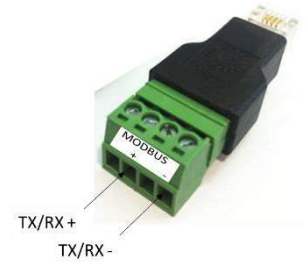


When using the RS-485 and MLINK ports as an acquisition bus (MLINK protocol) no devices other than the Expansion Shelves can be connected to these ports.

10.3.1 MODBUS connector

When cabling MODBUS devices back to the RS-485 port of FUSION, it may be convenient to use the "MODBUS connector" to convert the RJ-12 connector type to a screw type terminal.

The MODBUS connector is an 4-pin screw terminal and meant for two-wire MODBUS module connection. Thus only 2 pins are used, **TX/RX +** and **TX/RX -** are well indicated on the connector. We recommend using AWG #20 to #26 stranded wires.



For ordering, the part number is C-7000-MOD.

10.3.2 MLINK and RS-485 ports configuration

MLINK communication port configuration is displayed under the **System Information** main menu. Click on **Rear MLINK** on the left submenu and the port configuration is displayed.

To configure the **MLINK** communication port click on **Config** on the top menu (Supervisor access only) and then choose **Communication ports** on the left submenu. Click on **COMMLINK**.

Table 73 - MLINK Port Configuration Parameters

Parameters	Description	Default Value
Protocol	Protocol to be configured at the MLINK port. This port can be disabled by selecting "NONE". Select: MLINK , MODBUS or NONE .	MLINK
Baud rate	This parameter is available for configuration only is the option MODBUS has been selected in the protocol parameter. Select: 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200.	2400
Configuration	This parameter is available for configuration only is the option MODBUS has been selected in the protocol parameter. Select: RS-485 (2 wires) or RS-422 (4 wires).	RS-485 (2 wires)
Number of IDLE char to wait	This parameter is available for configuration only when the option MODBUS has been selected in the protocol parameter. At the end of the communication event FUSION waits a certain amount of characters before considering that the module has sent all information. This parameter is device dependant as some modules have slower processing time than others. Choice 1 to 255.	5

The RS-485 communication port configuration is displayed under the **System Information** main menu. Click on **Rear RS-485** on the left submenu and the port configuration is displayed.

To configure the **RS-485** rear communication port click on **Config** on the top menu (Supervisor access only) and then choose **Communication ports** on the left submenu. Click on **COMRS485**.

Table 74 - RS-485 rear Port Configuration Parameters

Parameters	Description	Default Value
Protocol	Protocol to be configured at the RS-485 rear port. This port can be disabled by selecting "NONE". Select: Terminal , MLINK , ISNMS , MODBUS , NONE or Port Forwarding . (The ISNMS protocol is a proprietary protocol used for a particular customer)	MODBUS
Baud rate	This parameter is not available for configuration if the MLINK protocol has been selected in the protocol parameter. Select: 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200.	19200
Configuration	This parameter is not available for configuration if the MLINK protocol has been selected in the protocol parameter. Select: RS-485 (2 wires) or RS-422 (4 wires).	RS-485(2wires)
Number of IDLE char to wait	This parameter is available for configuration only when the option MODBUS has been selected in the protocol parameter. At the end of the communication event FUSION waits a certain amount of characters before considering that the module has sent all information. This parameter is device dependant as some modules have slower processing time than others. Choice 1 to 255.	5
Device	This parameter is not available for configuration if the MLINK protocol has been selected in the protocol parameter. Select: None or Modem. When there is no modem connected, the choice should be None.	None
Modem configuration string	This parameter is available for configuration only when Modem has been selected in the Device parameter. Certain types of modems installed on personal computers may require that initialisation parameters be setup (Hayes command string of characters) in order to obtain a reliable modem connection.	
Number of rings before answering	This parameter is available for configuration only when Modem has been selected in the Device parameter. Select: 1 to 8	3

10.3.3 MODBUS MODULES

Because customer requirement needs for monitoring vary, FUSION is designed to be easily and efficiently adapted to different monitoring needs. FUSION can be set up to perform many different applications using the variety of commercially available MODBUS modules. E.g. Energy Management, AC power measurement, Power Quality measurements, Building automation and many others. For full specifications, see <http://www.modbus.org/specs.php>.

The MODBUS modules are installed at the monitoring location and are networked using the RS-485 network communication ports. Analog and binary information is sent from site infrastructure equipment to FUSION. These modules can send information at significant distances through the RS-485 subnet. This simplifies cabling and significantly reduces installation time. This feature makes FUSION a powerful tool for managing many different kinds of telecommunication infrastructures.

FUSION currently supports up to 64 MODBUS modules on either MLINK or RS-485 rear communication ports or shared between these two ports.

FUSION's MODBUS modules are divided in 3 different types: the "Generic modules", which are not supplied by Multitel, the "SMX-48BI module" and "SMX-24 AI module" which are Multitel's Smart Module Expansion acquisition cards communicating with the FUSION using the MODBUS RTU protocol. For the "Generic modules",

Multitel can recommend specific modules for Environmental, AC power and Energy Monitoring. Multitel can also offer its engineering experience to test and/or qualify specific modules. Please contact Multitel Customer Service Center www.multitel.com for more information.

Following are a few examples of commercially available general MODBUS modules which support the MODBUS RTU protocol over a two-wire RS-485 communication link. A mix of these modules can be configured on the same RS-485 subnet to retrieve the analog and binary input values at speeds of up to 115kbps.



For further details on configuration of the MODBUS modules refer to the FUSION SETUP section 4.8 SMX and Generic MODBUS MODULES (64).

10.3.4 MODBUS RTU protocol

The MODBUS RTU protocol is a widely used serial communication protocol for industrial field applications. It is a simple and robust industry communication standard. It works on the MASTER/SLAVE model. The FUSION (MASTER) is used to read and write information to and from the MODBUS modules. The MODBUS RTU format follows the command/data with a cyclic redundancy check as an error verification mechanism.

10.3.5 External Private Data Network (PDN) connection

FUSION can be remotely accessed over a PDN (X.25 Network) when using a Permanent Virtual Connection (PVC) with a PVC-type Packet Assembler-Disassembler (PAD) as the communication interface. The back panel RS-232 or RS-485 port may be used to connect one end of the PAD to FUSION. The other end is normally a special connection to the X.25 network. Specific considerations may be required upon installation and configuration. Please refer to the network specialist or to the documentation supplied with the PAD.

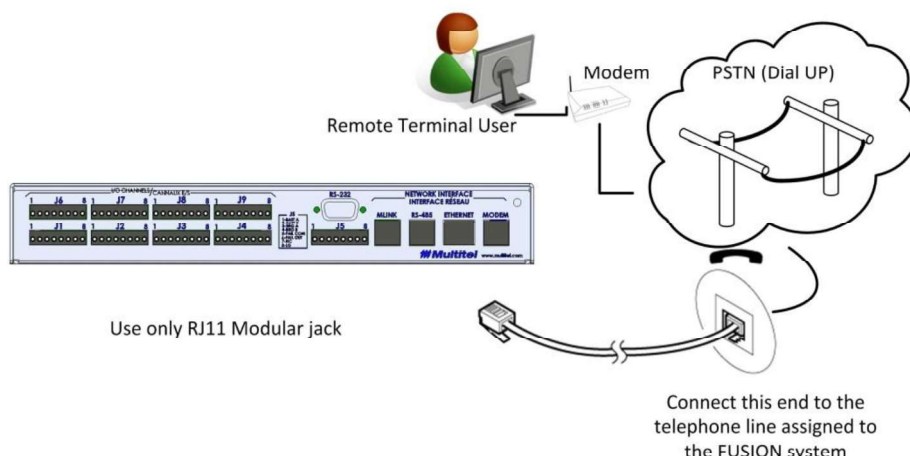
For more information contact Multitel Customer Service ([CUSTOMER SERVICE CONTACT](#)).

10.4 REAR 56K MODEM (OPTIONAL)

The 56k modem option provides a way to connect FUSION to the Public Switch Telephone Network (PSTN). This modem enables FUSION to be remotely accessed at communication speeds up to 56kbps.

A standard (RJ-11/12) modular jack designated MODEM is available on the back panel of FUSION to terminate the analog telephone line. PBX or digital loop subscriber lines are not compatible with the built-in modem. The MODEM can be set to answer calls or to originate calls to a predetermined destination when a user programmable event occurs.

Figure 20 - Modem connection



The modem may be used to re-transmit alarm messages to a remote alarm collector system. It operates at a baud rate of up to 56k either in "ANSWER MODE" (to receive calls) or "ORIGINATE MODE" (for automatic callouts). The modem is IC-03 and FCC part 68 compliant. The 56k modem provided is only compatible with regular analog telephone lines (POTs lines). It will not work on PBX digital lines.

1. Connect one end of the modular cable supplied with FUSION to the RJ11 jack designated "MODEM" at the back of the unit. Refer to the INSTALLATION section.
2. Connect the other end to the telephone line (modular telephone box). The "TIP" and "RING" are not polarized and are placed in the two (2) center pins of the RJ11 jack.

Table 75 - Modem connector definition (RJ-12)

PIN	Signal Direction	Description
1	N/A	Not Used
2	N/A	Not Used
3	In/Out	TIP
4	In/Out	RING
5	N/A	Not Used
6	N/A	Not Used

Dial the assigned FUSION telephone number using a personal computer with installed communication software and an internal or external modem connected to an analog telephone line. FUSION will answer after the pre-set number of rings configured in the settings of the communication port. However certain types of internal or external modem installed on personal computers may require that initialisation parameters be setup (Hayes

command string of characters or mini configurable switches) in order to obtain a reliable modem connection. Refer to the modem manufacturer documentation. The 56k modem automatically sets itself to the baud rate of the caller. After modem handshaking communication is established and user login is requested.

10.4.1 56K modem configuration

To configure the internal modem port, click on **Config** on the top menu (Supervisor access only) and then choose **Communication ports** on the left submenu. Click on **COMIPOINT**

Table 76 - Internal modem Port Configuration Parameters

Parameters	Description	Default Value
Protocol	<p>Protocol to be configured at the Internal modem port. This port can be disabled by selecting "NONE".</p> <p>Select: between the following protocols:</p> <ol style="list-style-type: none"> 1. Terminal (default value) 2. ISNMS (Customer Proprietary Protocol) 3. NONE 4. *Dialup Bridge - Use with caution (See Dialup bridge feature in section 7.2) <p>*Warning: When the Dialup bridge protocol is selected, the modem port will no longer respond to any terminal session other than FUSION callouts.</p>	Terminal
Baud rate	<p>This parameter is not available for configuration if the MLINK protocol has been selected in the protocol parameter. Select: 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200.</p>	9600
Modem configuration string	<p>Certain types of modem installed on personal computers may require that initialisation parameters be setup (Hayes command string of characters) in order to obtain a reliable modem connection.</p>	
Number of rings before answering	Select: 1 to 8	1

The modem operating mode is also set up using the Callout function, Refer to section [8.1 CALLOUTS](#) (32).

IMPORTANT NOTE:

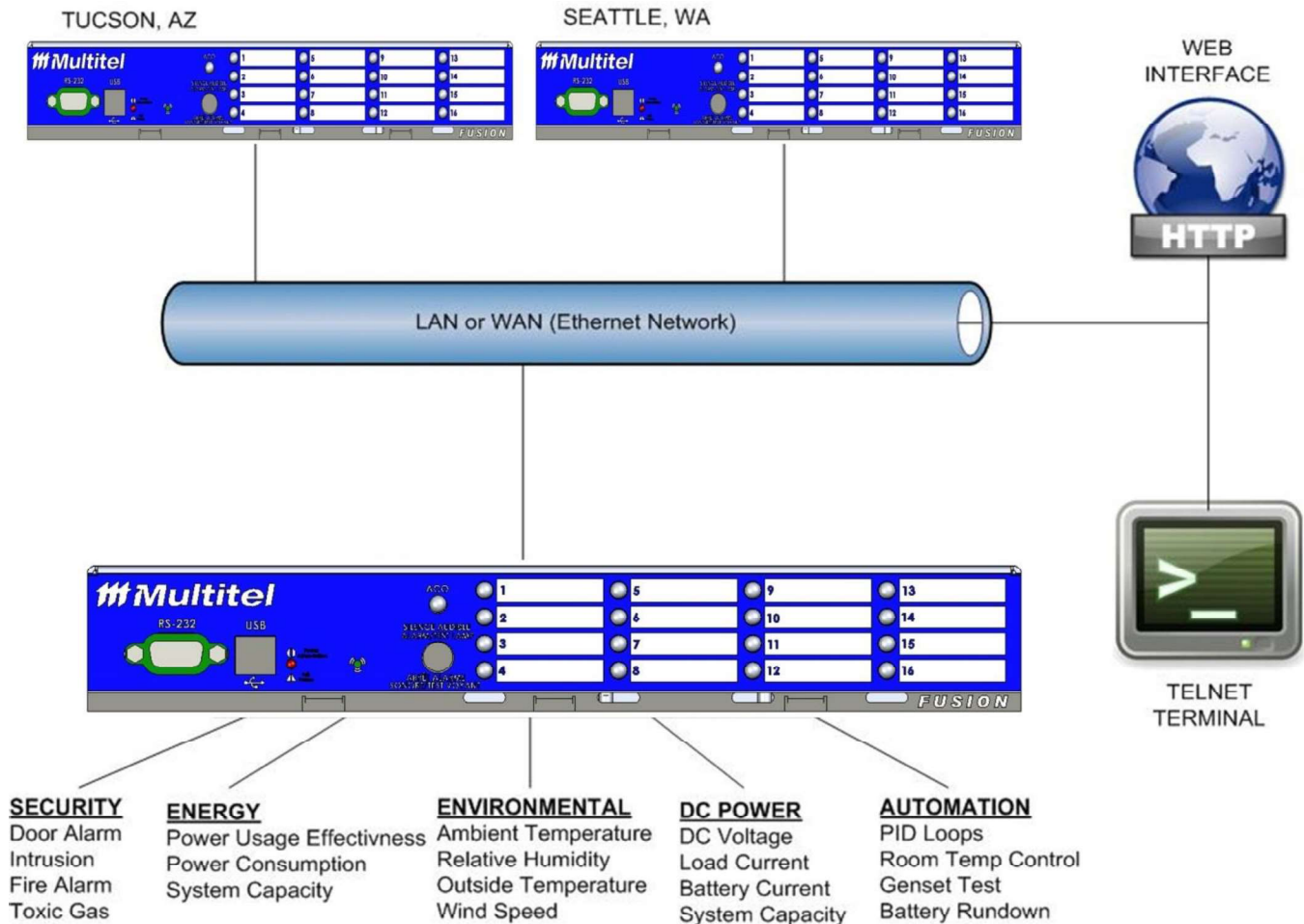


The selection of the **Dialup bridge** protocol for the MODEM Port will prevent remote user from making and processing a standard terminal session. The **Dialup bridge** is a machine to machine protocol and therefore the Command Line Interface commands used by human to interface with the FUSION are no longer available to users. To revert back, use the Ethernet port or local USB/RS-232 to modify the MODEM Port protocol.

10.5 REAR ETHERNET PORT

FUSION provides an Ethernet connection for remote access via a HTTP(S) browser or a terminal emulation session. For best results Microsoft™ Internet Explorer v6.0 or above is recommended. The default IP address programmed in the unit is 192.168.1.1. The Ethernet port is 10/100Mbit and can support as many as three (3) simultaneous communications.

Figure 21 - Typical LAN connections

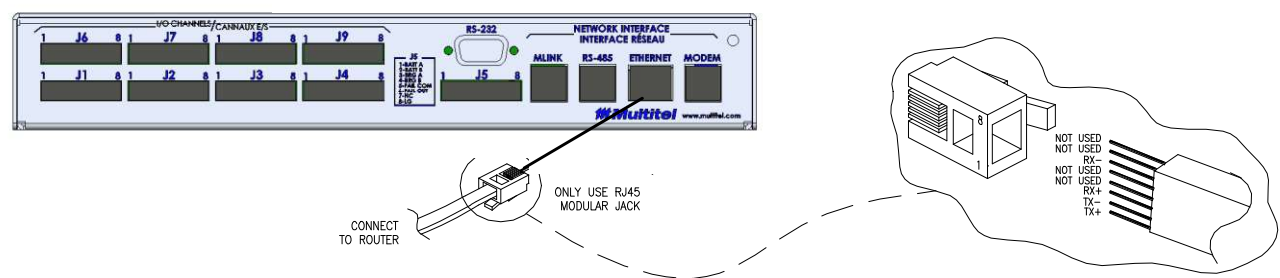


10.5.1 Ethernet connection

An AUTO MDIX RJ-45 modular jack designated "ETHERNET" is available on the back panel of FUSION to terminate the Ethernet cable. Multitel recommends the use of a straight cable. This jack also has the ability to automatically switch if a cross-over cable is connected using Automatic Medium-Dependent Interface Crossover (Auto-MDIX) technology. Contact the network administrator/manager for the required information for connection.

Auto-MDIX is a computer networking technology developed by HP. It automatically detects the required cable connection type (straight-through or crossover) and configures the appropriate connection which eliminates the need for crossover cables to connect FUSION with a PC. For Auto-MDIX to operate correctly the speed on the interface and duplex setting must be set to "auto".

Figure 22 - Ethernet connection

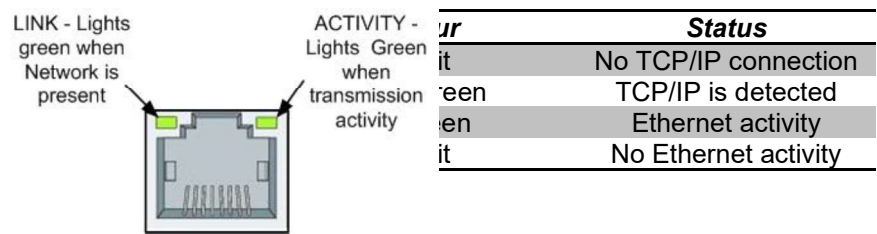


This Ethernet port can be used to send intelligent alarm messages. Refer to sections [8.1.6 Intelligent text message](#) and [8.1 CALLOUTS \(32\)](#) for details.

Table 77 - Ethernet connector definition (RJ-45)

PIN	Signal Direction	Description
1	Out	TX "+" Transmit Data – Positive
2	Out	TX "-" Transmit Data – Negative
3	In	RX "+" Receive Data - Positive
4	N/A	Not Used
5	N/A	Not Used
6	In	RX "-" Receive Data – Negative
7	N/A	Not Used
8	N/A	Not Used

There are two (2) LEDs on the RJ45 connector to indicate the network status and the communication activity.



10.5.2 TCP/IP stack protocol (DNS)

The FUSION is equipped with TCP/IP stack protocol to allow DNS client and future integration into IPv6 Ethernet network. Before explaining the concept, here are some explanations for the various acronyms:

- TCP: Transmission Control Protocol
- IP: Internet Protocol
- DNS: Domain Name System
- IPv6: Internet Protocol version 6 (version 4 is now used)

The TCP/IP protocol is basically a set of rules for communication between computers where each host is assigned a unique IP address which is valid on a particular network. All modern networks use TCP/IP for communication. The TCP/IP stack protocol provides TCP congestion controls, RTT (Round Trip Time) estimation and fast recovery/retransmitting extended features.

DNS

Every device on the Ethernet is assigned an IP address and navigating through them using the 12 digit IP addresses is very cumbersome. The DNS server allows a domain name to be used as a pseudonym for a specific IP address. A domain name is a unique name identifying an Ethernet resource (e.g.: multitel.com). For the specific application of the FUSION, DNS is permanently activated and is used to find IP addresses for SNMP managers, NTP servers, SNMPget modules, Ping function, Callout function, SMTP Email protocol function, Radius and Syslog servers. So, when you type a domain name instead of an IP address, FUSION looks up the name on an available DNS server and resolves it to its IP address.

10.5.3 100 BASE/T Ethernet port configuration

The Ethernet communication port configuration is displayed under the **System Information** main menu. Click on **Ethernet** on the left submenu and the port configuration is displayed.

To configure the **Ethernet port**, click on **Config** on the top menu (Supervisor access only) and then choose **Communication ports** on the left submenu. Click on **COMPORT**. Warning: Changing any one of the parameters in the following table will cause a reboot.

Table 78 - Ethernet Port Configuration Parameters

Parameters	Description	Default Value
IP address	FUSION IP address. Format: NNN.NNN.NNN.NNN	192.168.1.1
Subnet mask	Format: NNN.NNN.NNN.NNN	255.255.255.0
Default gateway	Format: NNN.NNN.NNN.NNN	Not Programmed
Domain name server 1	Format: NNN.NNN.NNN.NNN	Not Programmed
Domain name server 2	Format: NNN.NNN.NNN.NNN	Not Programmed
Ethernet speed	Select: AUTO, 100Mbps or 10Mbps	AUTO
Ethernet cable type	Select: AUTO, Normal or Cross-over	AUTO
Use HTTPS	Choose HTTPS (secure protocol for the HTTP(S) interface) Select: No or Yes	No

Ethernet port configuration parameters are saved in non-volatile memory. If the configuration file or total operation parameters (configuration) are lost or deleted FUSION will automatically detect the address 0.0.0.0 and will reconfigure the IP port with the saved parameters from the previous configuration.

Setting the IP address:

IP address: NNN.NNN.NNN.NNN

The IP address must be set to a unique value in the network. (See APPENDIX A – IP ADDRESS AND SUBNET MASK). The default IP address for FUSION is 192.168.1.1

The network administrator/manager will provide the IP address and port number dedicated to FUSION 10BaseT/100BaseT connection. Since FUSION can only address one application the Telnet terminal is commonly assigned TCP port number 23 (standard port value for Telnet communications). The SSH terminal is assigned TCP port number 22.

10.5.4 TCP port configuration

To configure the **TCP port**, click on **Config** from the top menu (Supervisor access only) and then choose **Telnet/SSH TCP Port** on the left submenu.

Table 79 - TCP Port Configuration Parameters

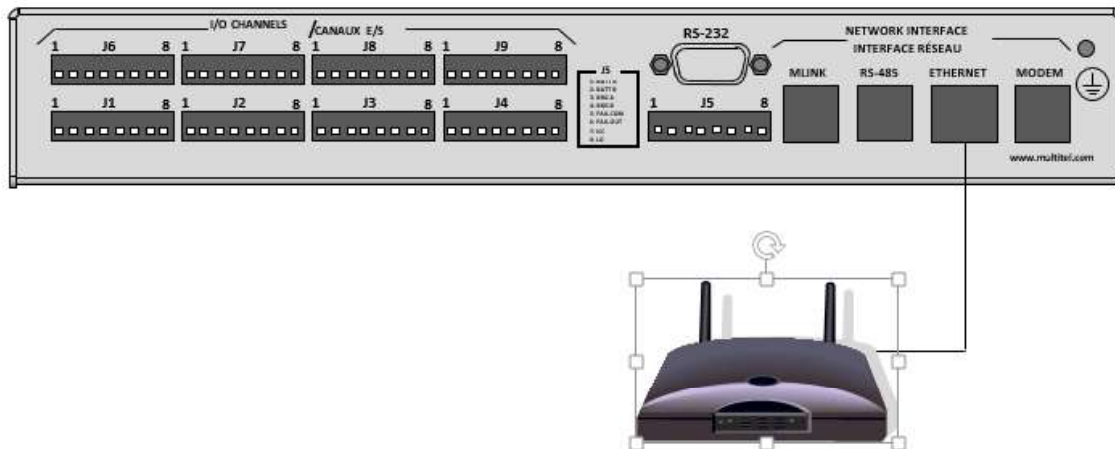
Parameters	Description	Default Value
SSH TCP port	TCP port used for SSH communication. Note that SSH can be deactivated in the General System Parameters configuration. A change to the SSH TCP port will close all SSH sessions. Telnet and SSH cannot be active at the same time, it is either SSH, Telnet or neither of the two protocols.	22
Telnet TCP port	TCP port used for Telnet communication. Note that Telnet communication can be deactivated in the General System Parameters configuration. Telnet and SSH cannot be active at the same time, it is either SSH, Telnet or neither of the two protocols.	23
Multitel Protocol TCP port	TCP port used for communication using Multitel's proprietary protocol.	2000
ISNMS TCP port	The ISNMS protocol is a proprietary protocol used for a particular customer.	Not Programmed

10.5.5 Ethernet cellular router

An Ethernet Cellular Router High Speed Packet Access (HSPA) can be installed on the Ethernet port for sites with no access to land line networks but where cell service is available. Multitel is a distributor of certified modems for FUSION but not for network connection packages. The major Canadian and American cell services providers offer monthly packages for Mega to Giga bytes data transfer volumes for their respective territories. If the FUSION is to be used from a mobile station it is important to note that getting close to the border regions of neighbouring countries could create roaming connections to one of their networks and thus will affect the price plan package. It is important to specify to the service provider that the service is going to be used for linking up and accepting an "entering connection" when subscribing. The service provider will provide a static IP address for the router.

Following some tests using cellular communication with FUSION, the monthly data transfer has been estimated to be approximately 50 Mega Bytes. The tests have been based on 24 daily communication activities where channel states, statistic and historic files and callouts were generated. This is an estimate only and the numbers can fluctuate according to the configured number of channels, alarms and the polling configuration of FUSION. Practical testing should be done to better plan the operating costs of such an arrangement.

Figure 23 - Typical cellular router connections



10.5.6 NTP protocol

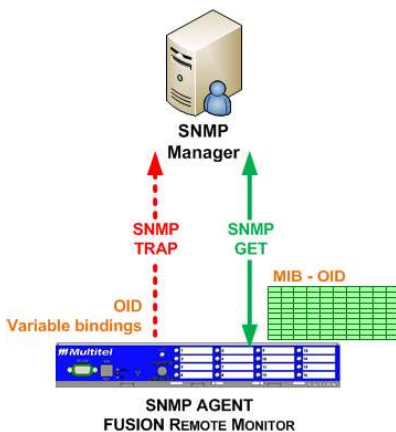
NTP is a networking protocol for clock synchronization between computer systems. On large sites with many computers and monitoring devices it is important to synchronize all device's clocks to be able to manage different events and alarms happening throughout the entire site. NTP protocol configuration is performed in the "General System Parameters", section [4.3](#).

10.5.7 SNMP protocol

Simple Network Management Protocol (SNMP) is the most dominant network management standard in the Information Technology and Communications Industry. It enables communication and control of open standard host systems for centralized management of multiple FUSION devices.

A number of vendors such as HP OpenView™, IBM NetView™, Lucent OneVision™, and Sun Micro's NetManager™ have adopted the standard for telecommunication and computer equipment network management. A standard Management Information Base (MIB) for FUSION is available by contacting Multitel Customer Service. www.multitel.com

FUSION supports SNMP v1 \ v2c \ v3 (GET, WALK and TRAPs) based on RFC standards applicable to this protocol. The information provided in this section is structured for users knowledgeable of the SNMP protocol. The SNMP protocol is typically used by IP network administrators. Less experienced users will find a wealth of information on the Web. See below for further information on FUSION setup according to specific monitoring applications.



Originally SNMP was used by IP network administrators to access and report information from network elements such as printers, routers or any other standard IP equipment. Use of the SNMP protocol has gradually expanded to incorporate other equipment connected on the IP network such as DC power supply, HVAC, RTU etc.

Each SNMP device (Agent) manufacturer who integrates the SNMP protocol must be registered with the international agency that grants the right to use Object Identifiers (OID). OIDs are specific codes attached to the information provided by the SNMP device. These OIDs are organized in reference tables called Mibs which are integrated into the device. Multitel provides Mibs files on the CD provided with the product. The Mib should be used for integration in the SNMP Manager for the interpretation of alarm messages and I/O channel status of the SNMP device. As mentioned earlier, Multitel integrates SNMP protocol in conformity with the RFC standards but does not use all its features. The Mib-specific to Multitel is called "Multitel Dome Mib" and includes the identifier "5946" in all OIDs.

The setup of SNMP operating parameters is performed using the HTTP(S) interface. (Refer to section [10.5.9](#)) The current SNMP settings are available on the HTTP(S) page under "System Information". When the SNMP setup is complete a validation can be performed either from the SNMP Manager platform (surveillance software) or using a "Mib Browser". FUSION supports the 3 available versions: v1 \ v2c \ v3 and supports the "Walk", "Get", "GetNext", "Getbulk", "GetSubtree".

See APPENDIX B - SNMP INFORMATION at the end of this manual for more information about the links between the OIDs of the "Multitel Dome Mib" and I/O channels mnemonics.

The v3 protocol provides authentication and encryption functionality. To take full advantage of these security features FUSION can be configured to operate exclusively with SNMP v3 protocol for the "Walk", "Get", "GetNext", "Getbulk", "GetSubtree". Supported by FUSION for encryption authentication purposes are formats: "MD5", "SHA1" or "None" and "DES", "AES" or "None". V3 includes a notion of "context name." The "context name" is user configurable and the default value is set to "DefaultContextName". These settings must be configured exactly the same between FUSION and the SNMP Manager otherwise communication will not be established between the two devices.

NOTE: FUSION is limited to sending SNMPv3 traps to only one SNMP Manager, thus security parameter configured in the destination #1 to destination #5 of "SNMP protocol" section will not be used.

10.5.8 SNMP trap

An SNMP trap and custom message can be configured to send callouts from FUSION.

Traps can be configured to be sent to a maximum of 5 "SNMP Managers" and each destination can be configured to operate with any SNMP version. If a "callout" is configured as a trap and is initiated by one of its triggering sources the trap will be sent to the configured SNMP Managers in the version in which they are configured. Traps will be sent as "Dome Trap Alarm" with specific OID containing "variable binding" for each device having a specific OID. If version v1 or v2c is selected the "community name" default value is "public." This can be changed by the user. If v3 is selected the authentication and encryption features must be configured. See APPENDIX B - SNMP INFORMATION for detailed information about Trap OIDs.

Traps supported in v1:

An "Authentication Failure Trap" is sent from FUSION to its configured SNMP Manager when it receives a request with an error coming from the "community name". The sending of this trap can be enabled or disabled via the command "SNMP".

NB: The "read only community name" and "trap" are configurable parameters in both the FUSION and the SNMP Manager. The default value is "public"

Traps supported in v1 \ v2c \ v3:

A "Trap Highest Priority Change" is sent when the highest alarm level changes in the device. This feature can be enabled or disabled.

A "Cold Start Trap" is sent when FUSION boots up.

Traps by specific alarm levels are sent by the FUSION callout function when the triggering condition is true. Each trap sent contains "Variable Binding" which is detailed information related to the alarm sent (e.g. product name, alarm level, identifying the related OID, symbol, name of alarm occurrence, message configured in the callout, hours the alarm).

Dome Trap Alarm Level 1 = Critical

Dome Trap Alarm Level 2 = Major

Dome Trap Alarm Level 3 = Minor

Dome Trap Alarm Level 4 = Information

Clear Dome Trap Alarm = Alarm Reset

An SNMP manager can also be used to read (GET) the channels on FUSION.

It is possible to use TAGs to customize SNMP and email messages with channel values. See Intelligent ASCII/limitedTL1 message section [8.1.6](#).

E.g.

Use the <CHANVAL:mnemo> variable to add the channel value.

Use the <VIEW:view number> variable to add the specified view data.

NOTE: FUSION is limited to sending SNMPv3 traps to only one SNMP Manager, thus security parameter configured in the destination #1 to destination #5 of "SNMP protocol" section will not be used.

10.5.9 SNMP protocol configuration parameters

To configure the **SNMP protocol**, click on **Config** from the top menu (Supervisor access only) and then choose **SNMP protocol** on the left submenu. This is a very specialized domain and assistance from the local network specialist may be required to configure these parameters.

Table 80 - SNMP protocol Configuration Parameters

Parameters	Description	Default Value
Community name for read only	Name of the group to which hosts running the SNMP service belong. Using a community name provides some security (like a password) as an SNMP agent won't respond to a request from a system outside its configured community.	Public
Enable the SNMP authentication Fail trap	Select: Yes or No	Enabled
Use SNMPv3 exclusively	Select: Yes or No	Not exclusive
SNMPv3 context name		DefaultContextName
SNMPv3 username		Public
SNMPv3 Authentication Protocol	Select: None, MD5 or SHA1	None
SNMPv3 Authentication Password		
SNMPv3 Privacy Protocol	Select: None, DES or AES	None
SNMPv3 Privacy Password		
Highest alarm priority change trap state	Select: Disabled or Enabled	Disabled
SNMP manager 1 The following parameters are the same for SNMP manager 1 to manager 5 (only manager 1 is shown on this table)		
IP address	IP address or domain name for manager 1. Format: xxx.xxx.xxx.xxx	Not Programmed
TRAP community name	Community name	public
TRAP version	Select: V1, V2c or V3	V1
SNMPv3 Username	Username for SNMPv3	Public
SNMPv3 Authentication Protocol	Select: None, MD5 or SHA1	None
SNMPv3 Authentication Password		
SNMPv3 Privacy Protocol	This parameter is available for configuration only if the MD5 protocol has been selected at the SNMPv3 Authentication Protocol. Select: None, DES or AES	None

Parameters	Description	Default Value
SNMPv3 Privacy Password		

SNMP operating parameters are also configured via 2 other functions:

- The **General System Parameters** function is used to configure the network machine name and the contact name. Configuration parameters are detailed in section 4.3.
- The **CALLOUT[x]** function is used to configure the operation mode (protocol, triggering mode...) for callouts. The CALLOUT parameters are detailed in section 8.1.

NOTE: FUSION is limited to sending SNMPv3 traps to only one SNMP Manager, thus security parameter configured in the destination #1 to destination #5 of "SNMP protocol" section will not be used.

10.5.10 SNMP parameter View on the HTTP(S) interface

SNMP parameter configuration is displayed on the HTTP(S) interface under the **System Information** menu by clicking on **SNMP** on the left submenu.

Parameter	Value
The community name for read only is	public
The SNMP Authentication Fail trap is	Enable
The SNMP V3 is	not exclusive
The SNMPv3 context name is	DefaultContextName
SNMPv3 User name	public
The SNMPv3 Authentication Protocol is	None
The SNMPv3 Privacy Protocol is	None
Highest alarm priority change trap	Disable
The SNMP manager 1 IP address is	192.168.1.70
The TRAP community name is	public
The TRAP version is	V1
SNMPv3 User name	public
The SNMPv3 Authentication Protocol is	None
The SNMP manager 2 IP address is	192.168.1.19
The TRAP community name is	public
The TRAP version is	V1
SNMPv3 User name	public
The SNMPv3 Authentication Protocol is	None
The SNMP manager 3 IP address is	Not Programmed
The TRAP community name is	public
The TRAP version is	V1
SNMPv3 User name	public
The SNMPv3 Authentication Protocol is	None
The SNMP manager 4 IP address is	Not Programmed
The TRAP community name is	public
The TRAP version is	V1
SNMPv3 User name	public
The SNMPv3 Authentication Protocol is	None
The SNMP manager 5 IP address is	Not Programmed
The TRAP community name is	public
The TRAP version is	V1
SNMPv3 User name	public
The SNMPv3 Authentication Protocol is	None

10.5.11 Email protocol (SMTP)

FUSION can send callouts via email. Up to four (4) email addresses can be configured along with a subject and a message for the callout.

To configure the Email protocol, click on **Config** from the top menu (Supervisor access only) and then choose **EMAIL protocol** on the left submenu.

Table 81 - EMAIL protocol Configuration Parameters

Parameters	Description	Default Value
Email server IP address	Enter IP address or domain name. Format: NNN.NNN.NNN.NNN	Not Programmed
Provenance email address	Enter provenance email address	Not Programmed

SMTP operating parameters are also configured via two (2) other functions:

- The **General System Parameters** function is used to configure the network machine name to authenticate FUSION on the SMTP server. Configuration parameters are detailed in section 4.3.
- The **CALLOUT[x]** function is used to configure the operation mode (protocol, triggering mode, destination email addresses 1 to 4...) for callouts. The CALLOUT parameters are detailed in section 8.1.

10.5.12 Protocol HTTPS

To enable or disable HTTPS protocol the user needs to go to the Ethernet port configuration. (See section 10.5.3 for details on port configuration parameters)

When secured communication is required and enabled Multitel recommends that the Telnet port be disabled to ensure communications are fully secured. Enabling and disabling the Telnet port is done in General System Parameters. (See section 4.3)

Multitel provides default keys and certificates that are neither legible nor recoverable. The certificate contains information about the owner, the public key and the digital fingerprint. The encryption process uses a private/public key pair that enables data to be encrypted by one key and decrypted by the other key. One key is kept private and the other one is public and normally distributed to everybody. It is possible that some browsers are unable to validate the key. In this case it is possible to simply agree to continue without validation. The customer has to upload their own key and certificate by using the **File Transfer** from the HTTP(S) interface top menu and then **Upload** on the left submenu. It is then possible to load the SSL Private Key and SSL Certificate.

Multitel recommends the use of Firefox browser to communicate in the secure http mode as other browsers make the communication unusable. Firefox lets you fix the TLS version supported and allows you to adjust the number of http persistent connection to increase performance with the FUSION web server. Please refer to section 1.4 HTTPS Performance.

For accessing FUSION's HTTP(S) interface when HTTPS mode is enabled type the IP address in the browser address bar the browser will automatically be redirected from HTTP to HTTPS. Certificate validation will be

exchanged for authentication and HTTPS will appear in the address bar. The whole HTTP(S) session is then secured.

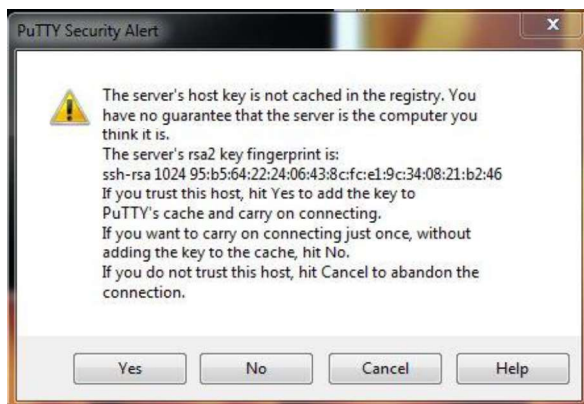
10.5.13 SSH protocol

SSH protocol (Secure Shell) is a cryptographic network protocol used in FUSION for secure data communication over an insecure network such as Ethernet. This protocol enables to connect via a secure channel, a server and a client running SSH server and SSH client respectively. FUSION mainly uses SSH for remote command line login and command execution, tunnelling, port forwarding and secure file transfer using XMODEM. SSH has the same basic concept as TELNET, it takes what you type and send it across the network to a remote computer. SSH however uses encryption so, unlike TELNET, the information passing over the network is not understandable when seen by an observer.

Our SSH protocol supports all the latest RFCs (Request for Comments) and is fully RFC compliant and interoperable with third party terminal emulators such as "PUTTY".

The encryption process is key based authentication and uses two keys; a public key that anyone is allowed to see and a private key that only the FUSION is allowed to own. FUSION is shipped from the factory equipped with automatically generated default keys but the customer can upload its own SSH RSA private keys by using the **File Transfer** from the HTTP(S) interface top menu and then **Upload** on the left submenu.

The first time you connect, via SSH, to a FUSION, you receive a warning like this one:



With this message, SSH is warning you that it doesn't know about this host yet. It shows you the fingerprint of the FUSION's public key; if you know what the fingerprint should be, it allows you to verify the host match. If you answer YES, it sends you its public key and the next time you establish an SSH connection, there will be no warning.

Enabling and disabling the SSH protocol is done in "General System Parameters" (See section 4.3). The same parameter is used to enable Telnet and SSH or disable both; this means that TELNET and SSH cannot be active at the same time, it is either one or the other or none.

10.5.14 RADIUS protocol

RADIUS (Remote Authentication Dial-In User) is a client/server protocol used for communication between FUSION, through a Network Access Server (NAS), and a RADIUS server. The use of this protocol allows authentication data centralization, meaning that FUSION can communicate with a RADIUS server to identify users on a centralized database. When the RADIUS protocol is deactivated or the RADIUS servers (primary and backup) not available, FUSION uses its own internal database. It is therefore recommended to keep at least one supervisor access configured in FUSION.

The RADIUS protocol is based on the AAA concept: Authentication, Authorization and Accounting. The authentication and authorization functions are coupled together. When the protocol is activated, FUSION passes information to the RADIUS server. When the RADIUS server receives a user connection request, it checks in its database; if the user is present and the password is correct, the RADIUS server returns access-accept response with configuration information necessary for the FUSION to deliver service to the user (access level, inactivity timeout, language and user rights).

The RADIUS accounting function allows data to be sent to the RADIUS server at the start and end of a user session. These data contain information like session time, data transferred and reason for disconnect; they are stored on the RADIUS server. The accounting function is optional and can be disabled.

Encrypted user passwords between FUSION and the RADIUS server are authenticated through the use of a shared secret which is present on both sides.

To configure the RADIUS protocol, click on **Config** from the top menu (Supervisor access only) and then choose **RADIUS protocol** on the left submenu.

Table 82 - RADIUS protocol Configuration Parameters

Parameters	Description	Default Value
State for the RADIUS protocol	The RADIUS protocol can be activated by enabling this parameter. Select: Disable or Enable	Disabled
Primary RADIUS server	Enter the primary RADIUS server's IP address or domain name. Format: xxx.xxx.xxx.xxx	Not Programmed
Shared secret	The shared secret is like a password that the RADIUS server and FUSION are sharing, it has to be entered on both sides. The shared secret is never sent over the network.	Not Programmed
RADIUS backup server	When the primary server is unavailable, the backup server becomes the RADIUS server for the communication. Enter the backup RADIUS server's IP address or domain name. Format: xxx.xxx.xxx.xxx	Not Programmed
Shared secret	The shared secret is like a password that the RADIUS server and FUSION are sharing, it has to be entered on both sides. The shared secret is never sent over the network.	Not Programmed
State for the RADIUS accounting	The accounting function can be disabled. Select: Disable or Enable	Enabled

RADIUS Server Configuration

FUSION's system has been tested with the FreeRADIUS.net free server; although it is possible to use any available server, configuration may change depending on the server being used. The following information contained in this user manual about server's configuration are however based on the FreeRADIUS.net precompiled Windows version.

The first step after installing FreeRADIUS.net software is to copy Multitel's RADIUS dictionary file to the FreeRADIUS.net\share\freeradius\ folder and then edit the dictionary file (the one with no extension) located in the same folder. This file is easily readable and editable using a simple text editor; once edited you have to add the following line at the end of the file: \$INCLUDE dictionary.multitel

Following is a copy of the Multitel's RADIUS dictionary file (this file is available on the Multitel's CD-ROM disc).

```
# _*_text_ _
#
# Multitel dictionary
# $Id: dictionary.multitel v1.0 07/05/2013 Pier-Olivier Hamel
#
VENDOR Multitel 5946

BEGIN-VENDOR Multitel

ATTRIBUTE Multitel-Access-Level 1 integer
ATTRIBUTE Multitel-User-Language 2 integer
ATTRIBUTE Multitel-Inactivity-Timeout 3 integer

VALUE Multitel-Access-Level Viewer 1
VALUE Multitel-Access-Level User 5
VALUE Multitel-Access-Level Supervisor 10

VALUE Multitel-User-Language English 0
VALUE Multitel-User-Language French 1

END-VENDOR Multitel
```

This dictionary allows referring to attributes and values with a logical name instead of numbers representing the associated field numbers for the protocol. Once the line added to the dictionary, FreeRADIUS will load Multitel's RADIUS dictionary file. The next step is to configure IP addresses that will be allowed to connect to the RADIUS server together with their respective shared secret. To do that, right-click on the FreeRADUS.net icon (once the software activated, the icon is located on the task bar) and choose the "Edit Radius Clients.conf" option. Once again, a simple text editor is necessary; then follow the instructions and explanations contained in the file.

Finally, Users need to be configured. Right-click on the FreeRADIUS.net icon and choose "Edit Users". The file contains many examples; however, with the specific FUSION application, only four parameters are requested. The syntax is as follows:

```
User1 User-Password == "password"
      Multitel-Access-Level =User,
      Multitel-User-Language = English,
      Multitel-Inactivity-Timeout = 2,
```

Where: User1 is the user name.
 User-Password is the password associated with the user.
 Multitel-Access-Level is the user access level (accepted values are: User, Viewer or Supervisor).
 Multitel-User-Language is the language configured for the user (accepted values are English or French).

Multitel-Inactivity-Timeout is the timeout time, in minutes, as configured in the FUSION's User parameters (accepted values: 0 à 255).

If one of these fields is missing, FUSION's default value will be used. Once all these values configured, FreeRADIUS.net has to be restarted (Restart FreeRADIUS Service in the menu) and it will then be ready for use.

10.5.15 SYSLOG protocol

SYSLOG is a very simple standard protocol used for data logging. It provides a transport to allow devices like FUSION to send event notification messages across IP networks to SYSLOG servers. These messages are stored in a database for troubleshooting purpose or statistics.

The messages are labeled with:

- a facility code indicating the type of software that generated the message
- a severity level to help with the priority selection of the message
- date and time
- the name of the machine that sent the message
- a text message (date and time, mnemonic, name and occurrence counter)

SYSLOG protocol facility and severity codes

Facility codes	Description	Severity codes	Description
0	Kernel message	0	Emergency: system is unusable
1	User-level message	1	Alert: action must be taken immediately
2	Mail system	2	Critical: critical conditions
3	System daemon	3	Error: error conditions
4	Security/authorization message	4	Warning: warning conditions
5	Message generated internally by syslog	5	Notice: normal but significant condition
6	Line printer subsystem	6	Informational: informational messages
7	Network news subsystem	7	Debug: debug-level messages
8	UCCP subsystem		
9	Clock daemon		
10	Security/authorization messages		
11	FTP daemon		
12	NTP subsystem		
13	Log audit		
14	Log alert		
15	Clock daemon		
16	Local use 0 (local0)		
17	Local use 1 (local1)		
18	Local use 2 (local2)		
19	Local use 3 (local3)		
20	Local use 4 (local4)		
21	Local use 5 (local5)		
22	Local use 6 (local6)		
23	Local use 7 (local7)		

For FUSION specific application, the system log file and history file are set to be compatible with the SYSLOG protocol. Every messages logged into these files are also send to the SYSLOG server when enabled. The server does not send an acknowledgment of the receipt message and there is no coordination between transmitter and receiver; so even if the protocol is enabled in FUSION and there is no server connected, messages will be sent and there will be no failure messages in FUSION.

Following is a table with the facility and severity codes used with FUSION's history and system log files.

<i>Event description</i>	<i>Facility code</i>	<i>Severity code</i>	<i>FUSION's file</i>
Added user	1	6	System log file (system)
Deleted user	1	6	System log file (system)
Disabled user	1	6	System log file (system)
Enabled user	1	6	System log file (system)
Changed password of a user	1	6	System log file (system)
Changed access rights of a user	1	6	System log file (system)
Uploaded new configuration file	3	6	System log file (system)
Uploaded new firmware file	3	6	System log file (system)
Device start-up	0	6	System log file (system)
Logged off	13	6	System log file
Authentication	13	6	System log file
Login fail	14	4	System log file
Wrong password	14	4	System log file
Critical	16	2	History log file
Major	16	3	History log file
Minor	16	4	History log file
Information	16	5	History log file

Examples of SYSLOG messages:

```
<133>May 3 16:37:13 aljgef BLOG: 2013/05/03 16:37:13 SUSER3 "SUPERVISOR" DIS
<6>May 3 16:37:13 aljgef SLOG: 2013/05/03 16:37 Device Start-up
<110>May 3 13:13:07 aljgef LOG: 2013/05/03 13:13 en Authenticated 192.168.0.14 HTTP
<14>May 3 13:15:44 aljgef SLOG: 2013/05/03 13:15 En Disabled user: Toto
```

The number between the brackets is called the priority value. The facility and severity codes can be calculated from this priority value. First, to get the facility code, you need to divide the priority value by 8 and keep only the integer portion of the number. The severity code is then obtained using the formula: Priority value – (Facility code * 8).

In the first example, the priority value is 133. The facility code is $133/8=16.6$, keeping only the integer part: 16. The severity code is: $133 - (16*8) = 5$. The priority code is followed by the date and time, the name of the FUSION device, BLOG (binary log) means the message comes from the history log file, date and time of the event and finally the event message.

In the messages, SLOG means the event message is a system message and it comes from the System log file. LOG means the event message comes from the System log file.

For the 3 other examples, using the same calculation method:

Priority code	Facility code	Severity code	Explanations
<6>	0	6	The message corresponds to a device start-up and comes from the System log file (system).
<110>	13	6	The message corresponds to a user log off and comes from the System log file.
<14>	1	6	The message corresponds to the disabling a user and comes from the System log file (system).

In FUSION, to configure the SYSLOG protocol, click on **Config** from the top menu (Supervisor access only) and then choose **SYSLOG protocol** on the left submenu.

Table 83 - SYSLOG protocol Configuration Parameters

Parameters	Description	Default Value
State for the SYSLOG protocol	The SYSLOG protocol can be activated by enabling this parameter. Select: Disable or Enable	Disabled
Destination IP address	Enter destination IP address or domain name for the SYSLOG server. Format: xxx.xxx.xxx.xxx	Not Programmed
Port number	The port number is like a channel used to make the connection with a remote IP device. Together with the device IP address it completes the destination address for a communication session. It is a standard and recommended to use port 514. Select: 1 to 65534	514
Minimum priority level to be transmitted	This parameter allows you to choose from which alarm levels messages are going to be send to the SYSLOG server. Select: none, critical, major to critical, minor to critical, info to critical and all.	none

11 SPECIFICATIONS

This section provides a summary of FUSION specifications. Multitel reserves the right to change and or modify product characteristics without notice, which may impact the technical specifications below.

11.1 MECHANICAL

Mechanical dimensions for FUSION and Expansion Shelf are as follows:

Table 84 - Mechanical dimensions for FUSION and Expansion Shelf

Components	Height	Width	Depth	Weight
FUSION	1.75 in. (4.45 cm) 1U rack space	11.2 in. (28.5 cm) excluding brackets	10 in. (25.4 cm) excluding connectors	7lb (3.18kg)
SMX-48BI & SMX-24AI module	1.50" (3.8 cm)	5.125" (13 cm)	8.57" (21.8 cm)	1.9lbs (0.86kg)
SMX 1UFS shelf	1.50" (3.8 cm)	7" (17,8 cm)	11.63" (29.5 cm)	2.2lbs (0.97kg)
SMX 1U3S shelf	1.50" (3.8 cm)	19" (48,3 cm)	11.63" (29.5 cm)	6.3lbs (2.85kg)
Expansion Shelf	4" (10.1 cm) 3U rack space	17" (43.2 cm)	12" (30.5 cm)	14lb (6.363kg)
ANALOG card	1.50" (3.8 cm)	5.125" (13 cm)	8.57" (21.8 cm)	1.40lbs (0.653kg)
EVENT card	1.50" (3.8 cm)	5.125" (13 cm)	8.57" (21.8 cm)	0.70lbs (0.325kg)
OUTPUT card	1.50" (3.8 cm)	5.125" (13 cm)	8.57" (21.8 cm)	0.86lbs (0.388kg)



Mechanical dimensions do not include the mounting bracket, wiring or back panel extension accessory.

11.2 ELECTRICAL

FUSION is powered by a DC Power Input. AC supply is possible only through an AC/DC converter. Please contact Multitel Customer Service to get more information about the use and specifications of the required AC/DC converter for the specific application requirement.

The following tables present the typical power consumption of FUSION and for each card. Recommended fusing is determined by the system maximum capacity. It is important not to exceed the recommended values as electrical fires or shocks may occur.

Table 85 - Typical power consumption for FUSION and each card

DC Voltage	48V	Watt	Fuse
FUSION fully loaded (display, modem, etc.)	145 mA	7	1 ¹ / ₃ to 2A max
SMX-48BI	50 mA	2.4	1 ¹ / ₃ to 2A max
SMX-24AI	75 mA	2.4	1 ¹ / ₃ to 2A max
Expansion Shelf	0mA	41	2A to 5A max
ANALOG card	110 mA	5.3	
EVENT card	82mA	3.9	

DC Voltage	48V	Watt	Fuse
OUTPUT card	172mA	8.2	

Typical Input Voltage	Input Voltage Range
-48Vdc	-40Vdc to -60Vdc

**IMPORTANT NOTE:**

The DC input that feeds the equipment shall be protected by 2A rated over current protection device provided as part of the building installation.

11.3 ENVIRONMENTAL

FUSION meets or exceeds the following operating temperatures. It is recommended that ventilation holes be kept clear during regular maintenance routines for better airflow circulation. The maximum operating altitude of FUSION is 7000ft (2000m).

Table 86 - FUSION and SMX operating temperature

Component	Minimum Operating temperature	Maximum Operating temperature	Operating Humidity (%RH)	Minimum Storage temperature	Maximum Storage temperature	Storage Humidity (%RH)
FUSION	-40°F (-40°C)	149°F (65°C)	5 to 90	-40°F (-40°C)	158°F (70°C)	0 to 95
SMX-48BI & SMX-24AI	-40°F (-40°C)	149°F (65°C)	5 to 90	-40°F (-40°C)	158°F (70°C)	0 to 95
I/O cards	32°F (0°C)	122°F (50°C)	5 to 90	-40°F (-40°C)	158°F (70°C)	0 to 95

11.4 TELECOM, DIGITAL AND SAFETY COMPLIANCE

FUSION and SMX modules have been tested for Digital Emissions and Safety and Telecom compliance. The table below provides detailed information about this test and other compliancy performance.

Table 87 - FUSION and SMX compliancy performance

Factor	Fusion performance
Terminal Equipment	Certified TIA-968 or FCC part 68 and CS-03 part 1
Electromagnetic compatibility (EMC)	Meets FCC Part 15, Subpart B, and ICES-003 requirements for both conducted and radiated EMI
Flammability	Abides by specifications set forth in UL 94V2 "Fire hazard tests."

Factor	Fusion performance
Electrical Safety	UL 60950-1 Issued: 2007/03/27 Ed: 2 Rev: 2014/10/14 and CSA C22.2#60950-1 Issued: 2007/03/27 Ed: 2 (R2012) Information Technology Equipment Safety Part 1: General Requirements
Heat Dissipation	Fully equipped the device generates no more than 10 watts (140 BTU/hr) Units can be stacked one above the other with 0-inch minimum spacing.
Earthquake Zone Requirements	Meets seismic conditions for Zone 4 (Bellcore TR-NWT-000063, part 5.6.3)
RoHS Compliancy	FUSION and SMX modules are RoHS compliant



11.4.1 Electrical Safety

The ETL Listed Mark indicates to distributors, retailers and customers that your product has been tested by Intertek and found in compliance with the following accepted national standards.

- The FUSION and SMX modules is certified to UL 60950-1 Issued: 2007/03/27 Ed: 2 Rev: 2014/10/14 Information Technology Equipment Safety Part 1: General Requirements.
- The FUSION and SMX modules conforms to CSA C22.2#60950-1 Issued: 2007/03/27 Ed: 2 (R2012) Information Technology Equipment Safety Part 1: General Requirements; Amd. 1: 2011, Amd. 2: 2014. The prod

11.4.2 RoHS Compliancy

As of June 2015, the FUSION and SMX modules are compliant with the new RoHS Directive. The new Directive officially known as Directive 2011/65/EU. The RoHS Directive restricts the use of Lead (Pb), Mercury (Hg), Cadmium (Cd), Hexavalent chromium (Cr6+), Polybrominated biphenyls (PBB), and Polybrominated diphenyl ether (PBDE) in manufacturing of certain electrical and electronic equipment sold in the European Union and North America.

11.4.3 ELECTROMAGNETIC INTERFERENCE (EMI)



FUSION and SMX modules both meet FCC Part 15, Subpart B, and ICES-003 requirements for both conducted and radiated EMI.

This device complies with TIA-968 (FCC Part 68) and CS-03. On the upper back surface of the device is the label containing the FCC registration number and ringer equivalence number (REN). If requested this information must be provided to the telephone company.

Facility Interface Codes: USOC Jack: RJ-11C.

A FCC-compliant telephone cord and modular plug is provided with this device. Further information can be found in the installation section.

The REN is useful to determine the quantity of devices that may be connected to a telephone line while ensuring that all devices will ring when the premises telephone number is dialed. In most areas the sum of RENs for all devices connected to one (1) line should not exceed five (5.0). If in doubt should check with the local service provider.

11.5 FUSION & SMX MODULE'S I/O CHANNELS

When equipped with cards for Hybrid I/O channels (EXP1, EXP2, EXP3 or EXP4) FUSION provides the detection of equipment alarms, measurement of energy system critical parameters and environmental conditions. FUSION can also control (turn ON/OFF) specific equipment operations. The table below illustrates the specifications for each I/O channel type found on these Hybrid I/O cards and the SMX-48BI. The SMX-48BI is a FUSION expansion module which provides up to 48 binary inputs. See Binary Input specification for detailed specifications that relates to this module.

Table 88 – FUSION, SMX-48BI & SMX-24AI I/O specifications

I/O channel	Components	Specifications
Humidity Input	1 x Humidity Channel (I/O card EXP1 only) Requires M-4109 transducer	A/D converter: 12 bits
		Resolution: +/-2000 samples
		Precision: +/- 5% RH
		Isolation: 150 Volts
		DC Signal overload: 75 DC Volts
		AC Signal overload: 75 Volts rms
		CMVR: 70 Volts
		Impedance: 500kOhms-1MOhms
Hybrid Analog Input	4 analog input channels (card EXP1) 6 analog input channels (card EXP2) 24 analog input channels (SMX-24AI)	Scan Rate: 10Hz
		A/D converter: 16 bits
		Resolution: 64000 samples
		Isolation: 150 Volts
		DC Signal overload: 150 DC Volts
		AC Signal overload: 75 Volts rms
		CMVR: 70 Volts
		Impedance: 500kOhms-1MOhms
Binary Input	13 binary input channels (card EXP1) 16 binary input channels (card EXP2) 32 binary input channels (card EXP3) 28 binary input channels (card EXP4) 48 binary input channels (SMX-48BI)	A/D converter: 12 bits
		Resolution: +/- 2000 samples
		DC Signal overload: 75 DC Volts
		CMVR: 70 Volts
		Scan Rate: 10Hz
		Impedance: 458Ohms
		Under AC load:
		Maximum operating voltage: 70 Volts
Binary Output (Relay)	3 x Relay C FORM (card EXP1) 3 x Relay A FORM (card EXP2) 3 x Relay A FORM (card EXP4)	Maximum operating current: 0.5Amps
		Under DC load:
		Rated load: 2A @ 30 Volts
		Maximum operating voltage: 70 Volts

11.6 COMMUNICATION PORTS

Table 89 – FUSION CRAFT port settings

	Front RS-232 port	Front USB 2.0 Port
Connector	DB-9 female	Type B
Configuration	DCE	N/A
Default Baud Rate	115200	115200
Connector Name	RS-232	USB
Driver	N/A	Available on CD ROM
Protocol	ASCII, ISNMS, XMODEM	ASCII, ISNMS, XMODEM
Echo	Full duplex	Full duplex
Emulation	ANSI or VT-100	ANSI or VT-100
Baud Rate	300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200

Table 90 – FUSION Network interface settings

	Modem	Ethernet	RS-232	MLINK	RS-485
Connector	RJ-12	RJ-45 (AUTO-MDIX)	DB-9 Female	RJ-11/12	RJ-11/12
Configuration	N/A	N/A	DTE	2 wire/4 wire	2 wire/4 wire
Connector Name	MODEM	ETHERNET	RS-232	RS-485	RS-485
Protocol	ASCII,ISNMS	ASCII, SNMP, HTTP, SMTP, XMODEM,ISNMS	ASCII, XMODEM	Proprietary ASCII MODBUS RTU	Proprietary ASCII,ISNMS MODBUS RTU
Echo	Full duplex	Full duplex	Full duplex	Full duplex	Full duplex
Emulation	ANSI or VT-100	ANSI or VT-100	ANSI or VT-100	ANSI or VT-100	ANSI or VT-100
Baud Rate	300, 1200, 2400, 4800, 9600, 14,400 , 33,600, 56,000	10/100 Mbps	300, 1200, 2400, 4800, 9600, 19 200, 38,400, 57,600, 115,5200	300, 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, 115,200	300, 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, 115,200

SMX Family MODBUS RS-485 Interface

RS-485	
Connector	3.5mm Plug in connector
Configuration	2 wire/4 wire
Connector Name	RS-485
Isolation	1.5kV
Protocol	MODBUS RTU
Echo	Full duplex
Emulation	None
Baud Rate	1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, 115,200

11.7 MODBUS MODULES

11.7.1 Generic MODBUS modules

Generic MODBUS modules are not manufactured by Multitel. These modules are commercially available and should be qualified before being installed by competent personnel. Each generic MODBUS module carries its own technical specifications which are not made available in this user manual. Please refer to the manufacturer's technical documentation for each generic MODBUS module. specifications.

Following are the technical limitations when using a MODBUS module with FUSION:

- The industry standard MODBUS RTU protocol is supported
- Communications is only available on RS-485 and MLINK communication ports over a half-duplex (two wires + common).
- As per RS-485 standards, Multitel recommends not exceeding 600ft between the FUSION and the MODBUS modules.
- Standard baud rates are 9600 and 19200, but adjustable up to 115200 baud
- 64 MODBUS modules can be managed by each FUSION device
 - 32 MODBUS module on the RS-485 port
 - 32 MODBUS module on the MLINK port
- Response time is adjustable between 5 and 300msec.

11.7.2 SMX Module (SMX-48BI & SMX-24AI)

The Smart Module Expansion is manufactured by Multitel. The technical specifications are provided the "SPECIFICATIONS" Chapter.

Following are the technical limitations when using a SMX modules with FUSION:

- Only the industry standard MODBUS RTU protocol is supported over the RS-485 and MLINK ports on a two wires configuration.
- Module should not exceed 600ft between the FUSION and the MODBUS modules.
- Up to 64 SMX-48BI can be managed by each FUSION device.
 - 32 MODBUS module on the RS-485 port
 - 32 MODBUS module on the MLINK port

Type	Component	Specifications
SMX Power and Environmental	Typical:	-48Vdc (2.4W)
	Range:	-40 to -60 Vdc
	Rec. Fused	1 1/3 Amp
	Oper. Temperature:	-40°F (-40°C) to 149°F (65°C)
	Humidity:	5 to 90 % RH (Non-condensing)
Dimensions	Height:	1.50 inch (3,81cm)
	Width:	5.48 inch (13,92cm)
	Depth:	10.50 inch (26,67cm) with GND stud
MODBUS/RS-485	Type:	2 wire RS-485
	Isolation:	1,5kV
	Baud Rate:	Adjustable from 1200 to 115 200 bps

11.8 EXPANSION SHELF I/O CARDS

The Expansion Shelf can contain up to five (5) I/O cards. There are three (3) types of I/O cards:

- ANALOG Cards for measurement of voltage, current, temperature etc.
- EVENT Cards for the detection of equipment failures or status changes through transducers
- OUTPUT Cards for issuing discrete alarms or controlling the operation of various equipment

Table 91 - Expansion shelf I/O card specifications

I/O Cards	Components	Specifications	
Analog Card	<ul style="list-style-type: none"> INTEL 80188EB microprocessor 32K byte EPROM memory 128K byte STATIC RAM memory A watchdog circuit 12-bit analog to digital converter A 24 or 48V DC/DC converter 18 real analog input channels 18 virtual analog channels 1 Power/Fail LED and Fail relay 	A/D converter:	12 bits
		Resolution:	2000 samples
		Precision:	2000 samples
		Isolation:	750 Volts
		DC Signal overload (Except for temperature, OSI and 4-20mA input channels):	50 -300 DCVolts
		AC Signal overload:	75 Volts rms
		CMVR:	1000 Volts
		Impedance:	500kOhms-1MOhms
Event Card	<ul style="list-style-type: none"> A Mitsubishi M50747 microprocessor 32kB EPROM memory 32kB STATIC RAM memory A watchdog circuit 8-bit Analog/Digital converter 24 or 48V DC/DC converter 48 binary input channel 1 Power/Fail LED and Fail relay 	A/D converter:	12 bits
		Resolution:	2000 samples
		Precision:	2000 samples
		DC Signal overload:	+/- 255 DC Volts
		Impedance:	1MOhms
Output Card	<ul style="list-style-type: none"> A Mitsubishi M50747 microprocessor. 32kB EPROM memory. 32kB STATIC RAM memory. A watchdog circuit. A 24 or 48V DC/DC converter. 32 user-programmable SPST micro-relays. 1 Power/Fail LED and Fail relay. 	Under AC load	
		Rated load:	0.4Amp @ 125 Volts
		Maximum operating voltage:	250 Volts
		Maximum operating current:	3Amps
		Maximum switching capacity:	50 VA
		Under DC load	
		Rated load:	2A @ 30 Volts
		Maximum operating voltage	220 Volts
		Maximum operating current:	3 Amps
		Maximum switching capacity:	60 Watts

11.9 DATE AND TIME PRECISION

FUSION is equipped with a Real-Time clock that keeps track of the date and time (century, year, month, hour, minutes, and seconds). It includes a Battery Backup circuit that keeps time even when the power is off. Other timekeeping functions include Alarm and Watchdog, and a calibration register where higher accuracy is required. The RTC is set at +/- one (1) minute a month at 25 °C. It is possible to set the date and time using the HTTP(S) interface under the System Information menu. The format is: (MM/DD/YYYY; HH:MM:SS) and cannot be changed.

FUSION has the ability to automatically adjust the real-time clock for the Daylight Saving Time (DST) period. For most Canadian and United States territories, DST begins at 2 a.m. on the second Sunday of March, and reverts to the standard time at 2 a.m. on the first Sunday of November. ([See section 4.3 General system parameters](#))

11.10 BATTERY BACKUP

FUSION is equipped with a Battery Backup Circuit in order to maintain timekeeping, statistics and history data and the device configuration in the event that the device is depowered. The battery life expectancy at 25 °C is typically 10 years. However the battery end of life is not guaranteed. For your information, the "Network Time Protocole" NTP feature enable the FUSION to synchronise its internal clock with an external server.

12 INSTALLATION

12.1 PREPARING TO INSTALL FUSION

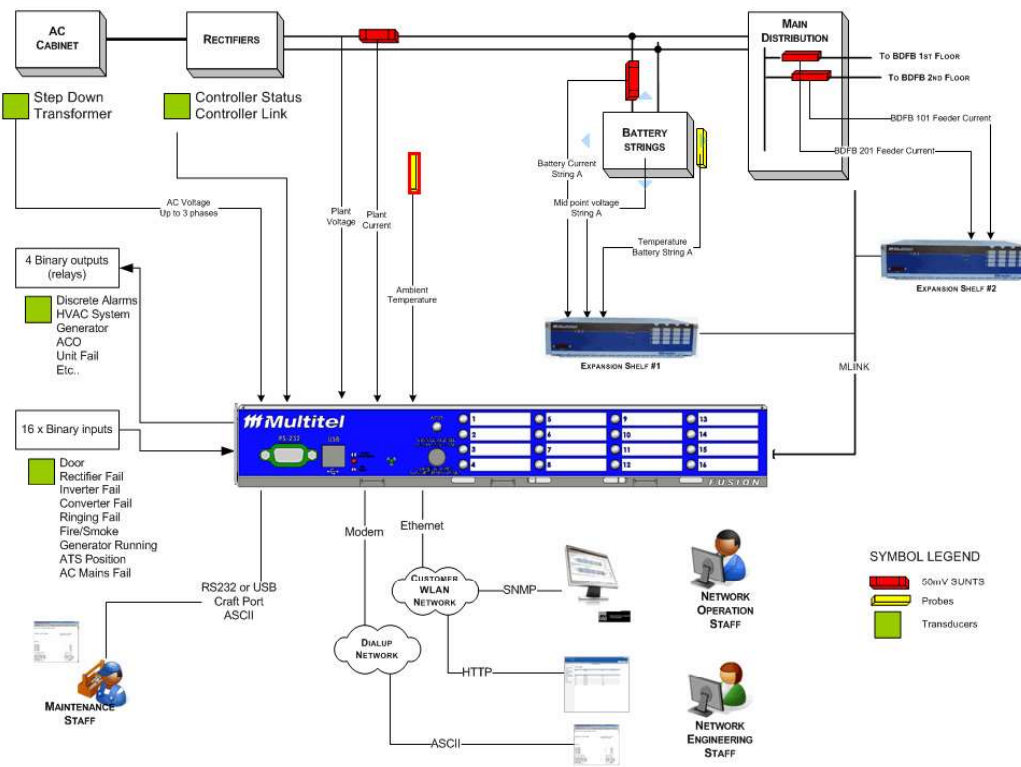
In accordance with Articles 100-16, 100-17 and 110-18 of the National Electrical Code, ANSI/NFPA # 70 1987 this equipment shall be installed in a restricted access area. It should be installed by qualified personnel as close as possible to the equipment to be monitored and/or controlled to reduce cabling and installation time. There are **maximum distances** that shall not be exceeded in order to maintain the highest level of performance possible. (See Table 93 - Maximum distances between the transducers and FUSION)

Before proceeding with FUSION's installation it is important to have a good understanding of the possible device relationships and interconnections. This type of information can be found in engineering or interconnection diagrams, methods of procedure or other specific application guides.

FUSION is a scalable system as it provides a set of hybrid I/O channels and a wide variety of Network Interfaces. I/O channel expansion is possible using the Expansion Shelf and Intelligent I/O Cards or using MODBUS modules through the serial communication bus (MODBUS RTU) and SNMPget modules via an IP network. This section provides guidelines for the FUSION installation process and wiring requirements and the installation and wiring of the Expansion Shelf.

For additional support please do not hesitate to contact the Multitel Customer Service Engineering Group at (418) 847-2255 or <mailto:support@multitel.com>.

Figure 24 - Typical infrastructure monitoring application



12.1.1 Equipment supplied by Multitel

Each FUSION is supplied with the following items:

- 5-9 x 8 pin screw type modular connectors (designated J1-J5 or J1-J9, Under option)
- 1 x modular telephone cable (5.6 ft/2m).
- 4 x thread rolling screws #12-24 (rack mounting screws)
- 2 x rack mounting brackets (fit both 19" and 23" racks)
- 8 x machine screws - slot drive #8-32
- 1 x IP and telephone number reference sticker
- 25 x blank stickers for LED alarm description (OPTIONAL)
- 1 x ring terminal for wire range 18-14 for ground lug
- 1 x hexagon locknut #8-32
- 1 x tooth lock washer #8
- 1 x Quick Reference Guide (French and English)



Before proceeding with installation verify that all material has been received and is in good condition.

12.1.2 Required tools and/or material not supplied by Multitel

- Ethernet cable
- RS-232 Cable
- Ground cable #14 AWG and ground lugs
- Stranded wire, #22 or 24 (to wire the analog input channels)
- Solid wire, #24 or 26 (to wire the alarms or binary input and output channels)
- Terminal lugs (fork type or others) #22-16
- In-line fuse holders (to protect FUSION from signals connected to the shunts or to any point other than ground Multitel ordering code : FSBL-TL)
- Fuses, 2 amp. and ½ amp.
- Shunt (sized as required) for battery current measurement
- Safety glasses or goggles
- Anti-static wrist strap
- Portable terminal or computer and a RS-232 cable or USB cable and adapter to access the system through the RS-232 port (as required)
- Direct RS-232 cable (pin 2 to 2 and pin 3 to 3) or USB Cable Type "A" Male to "B" Male
- Standard installation tools (various screw drivers, long nose, cutters, etc.)
- Digital voltmeter/multimeter, 3½ digit (or better)
- Ammeter 31/2 digits (or better).
- Crimping tool for the terminal lugs of certain accessories (fork type or others)
- Blade screwdriver 3/32" (2.4mm)

12.2 MOUNTING FUSION

FUSION is designed to be installed in a Telecom Central Office environment, but is also suitable for other industrial sectors. The FUSION can be rack or wall mounted and its chassis should be located as close as possible to the equipment that has to be physically connected to the system. [Refer to section 12.4 WIRING ANALOG INPUT CHANNELS](#) of this chapter to understand the limitations of reach for the various monitored

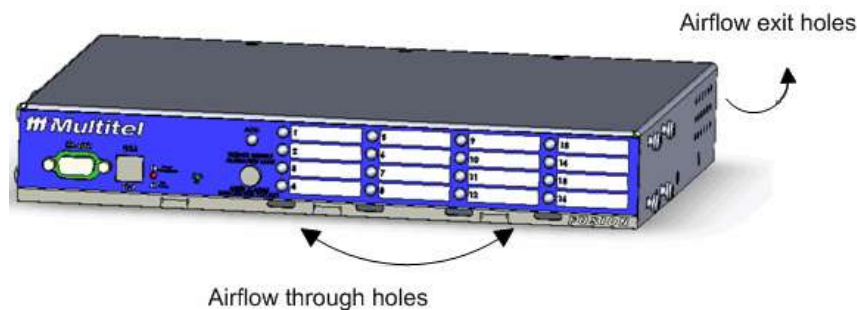
points. An optional Wall mount adapter can be acquired separately. Contact your sales representative for more details.

12.2.1 Airflow management

Ventilation holes have been positioned so that airflow passes through the chassis. If the equipment is inadequately ventilated product specifications can be affected and this will reduce system performance. In addition to this chassis panels made inaccessible by poor equipment placement can make system maintenance difficult. Outlined below are the precautions that will help avoid problems during installation and subsequent operations. For easy access and use FUSION should be installed at eye level for good visibility of visual indicators and provide easy access to the Craft Port.

FUSION draws cooling air through intake vents on the low-front of the chassis and moves air across internal components and out the exhaust vents on the chassis' rear-side.

Figure 25 - Air flow through chassis



12.2.2 Rack mounting

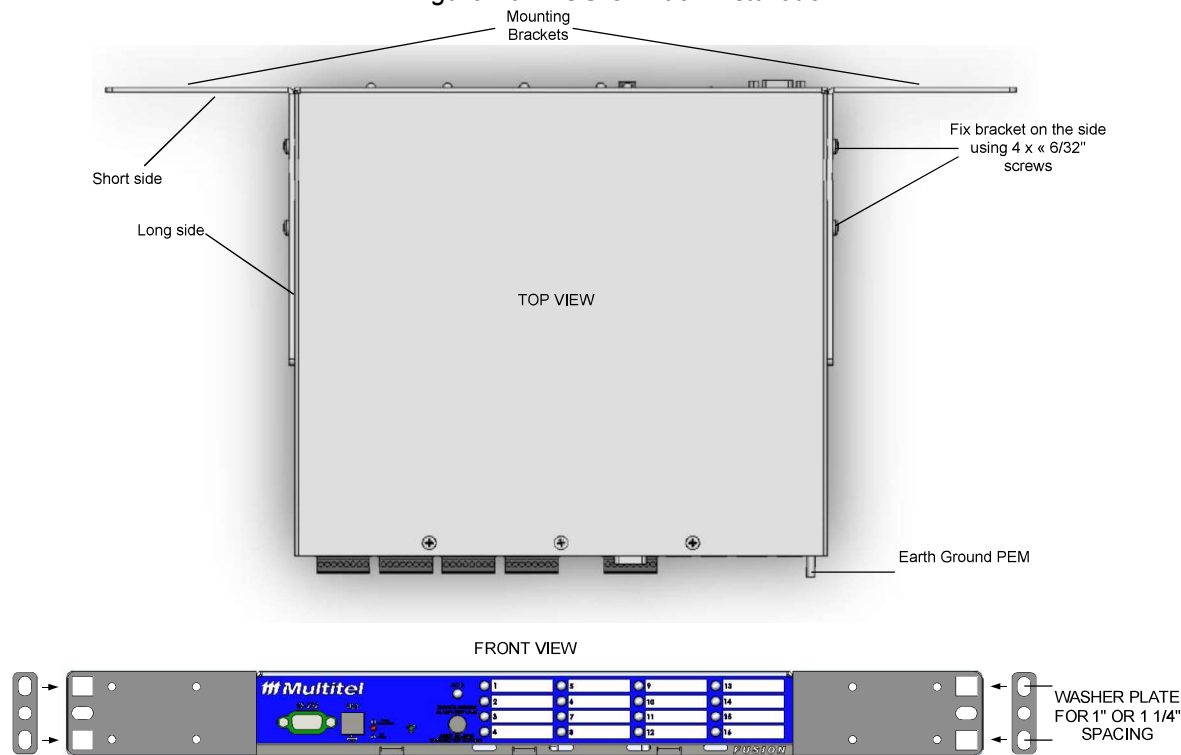
FUSION must be installed in standard 19" or 23" telecommunication relay racks. The provided mounting brackets adapt rack mounting for European and North American relay rack standards and provide a flush installation.

First install the two brackets supplied in the accessory kit.

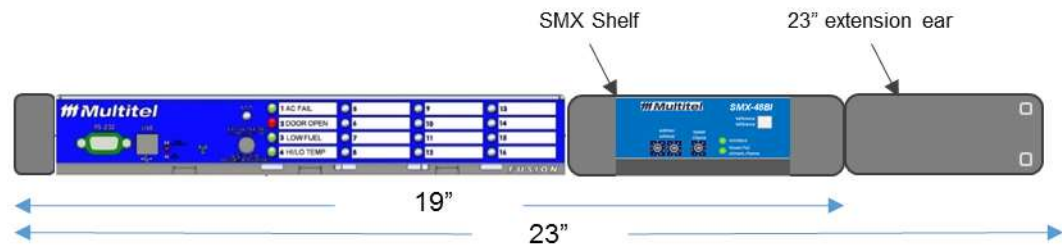
Brackets are represented in Figure 7 below for a 19" framework. The long side of the brackets is connected to the FUSION chassis and the short side of the bracket to the framework.

To mount the chassis in a 23" framework screw the short side of the brackets to the FUSION enclosure and the long side to the framework. The front end of the chassis is aligned with the framework with holes at 1" center or with holes at 1/2" center every 1 1/4". (See figure below)

Figure 26 - FUSION rack installation



If you have acquire the FUSION with the SMX shelf. All the installation material is provided for a 19" or 23" rack installation. Note that the "centered bracket" are not provided when this option is selected.



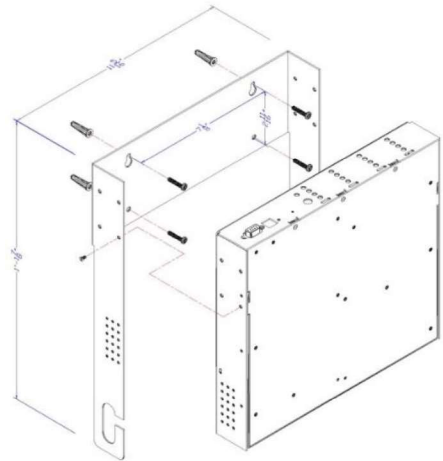
Following is an example of a FUSION installation with and without the SMX-48BI.



12.2.3 Wall mounting

FUSION can be wall mounted using a wall mount bracket. To do so, use the following instructions and illustration.

1. Mount the bracket on the wall using the anchors and wood screw provided.
2. Use the four (4) metal screws to fix the FUSION in the wall mount bracket.
3. Terminate the wire at the bottom of the FUSION and attach to the wall mount bracket.



Multitel reserves the right to change and or modify the wall mount bracket specification without notice.



12.2.4 Chassis ground

Once FUSION is installed in the rack the chassis must be connected to a reliable ground source. The ground wire shall be installed in accordance with local electrical safety standards.

- For NEC-compliant grounding a size 14 AWG (22 mm) or larger copper wire and an appropriate user-supplied ring terminal with an inner diameter of 1/4 inch (5 to 7 millimeters) are used for the installation.
- For EN/IEC 60950-compliant grounding a size 18 AWG (12 mm) or larger copper wire and an appropriate user-supplied ring terminal are used for the installation.

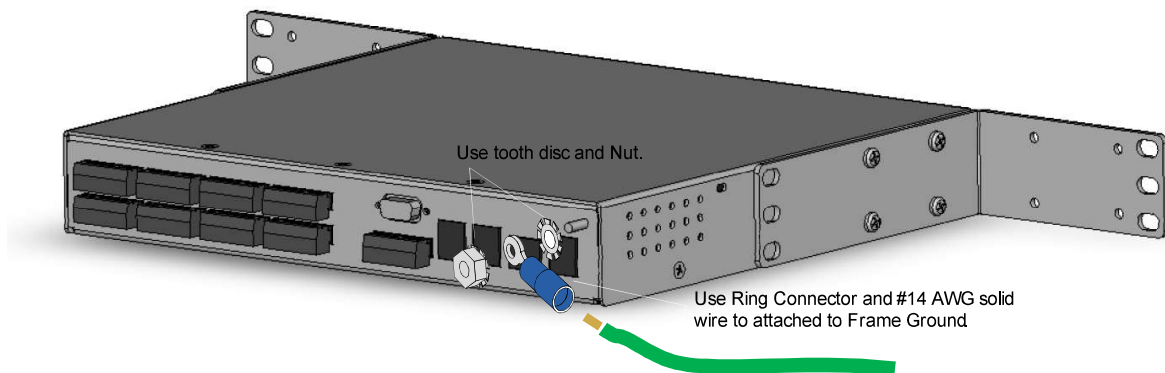


FUSION, SMX modules and the Expansion Shelf (when supplied with FUSION) must all be grounded. NEVER remove the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. It may be necessary to contact the appropriate electrical inspection authority or an electrician to ascertain that a suitable grounding is available.

Follow these steps to install the ground connection:

1. Strip one end of the ground wire to the length required for the ground lug or terminal.
2. Crimp the ground wire to the ground lug or ring terminal using a proper wire crimper of the appropriate size.
3. Attach the ground lug or ring terminal to the chassis as shown in the figure below. Use the nut and lock washer provided. Tighten the nut securely.

Figure 27 - Chassis ground



12.2.5 Wiring power input

FUSION is powered by a continuous -48Volt DC power source. The monitor is equipped with A & B feed positions for power redundancy. Both feeds must be powered; otherwise a system error will be generated unless the "FEEDA/FEEDB lost detection" is disabled in the **General System Parameters** settings. A readily accessible disconnect device shall be incorporated within the power wiring in order to disconnect the equipment from the 48Vdc supply for servicing. The source fuse, circuit breaker or in-line fuse should not exceed 2 Amps.



The colour coding for DC-input power supply leads depends on the colour coding for DC power source at the site. Ensure that the lead colour coding chosen for the DC-input power supply matches the lead colour coding used at the DC power source. It is important to wait until all wiring connections are made and verified before powering up the FUSION device.

Using an 18 gauge wire-stripping tool, strip each of the four wires coming from the DC-input power source to 0.25 inch (6.3 mm) + 0.02 inch (0.5 mm). Do not strip more than 0.29 inch (7.4 mm) of insulation from the wire. Stripping more than the recommended amount of wire can leave exposed wire from the terminal block plug after installation. Insert wires into the terminal block according to the following table.

Table 92 - Power connector definition

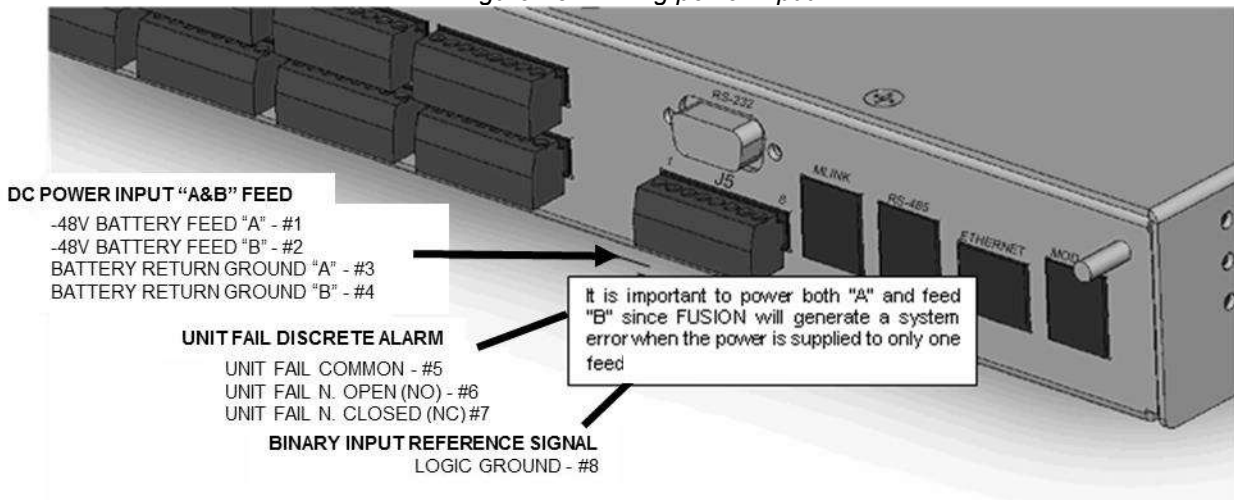
PIN	Name	Use	Type
8	LOGIC	Logic ground reference for binary input	IN
7		Not used	IN
6	FAILOUT	Unit fail relay output	OUT
5	FAILCOM	Unit fail relay common lead	IN
4	BRG -B	Battery return ground "B" feed	IN
3	BRG -A	Battery return ground "A" feed	IN
2	BATT -B	Battery -48V "B" feed	IN
1	BATT -A	Battery -48V "A" feed	IN

Note: The pin numbering for the connector is from left to right.



It is important to power both "A" and feed "B" since FUSION will generate a system error when power is supplied to only one feed unless the "FEEDA/FEEDB lost detection" is disabled in the **General System Parameters** settings.

Figure 28 - Wiring power input



12.3 WIRING I/O CHANNELS

FUSION & SMX Modules can provide a mix of Analog, Binary Input and Relay Output Channels. Analog channels should be wired with #20, #22 or #24 AWG stranded wires. Binary Input and Relay Output should be wired with #22 or #24 AWG solid wires. The following tables describe the connections required for FUSION I/O channels and SMX-48BI and SMX-24AI.



It is important to ensure that the polarity is correct when wiring certain specific analog channel front ends such as: 0-65Vdc, 0-10Vdc and TEMP. When polarity is reversed the channel will not read correctly and will display 0.00 or +OVL.

Figure 29- I/O channels pin-out FUSION option EXP1

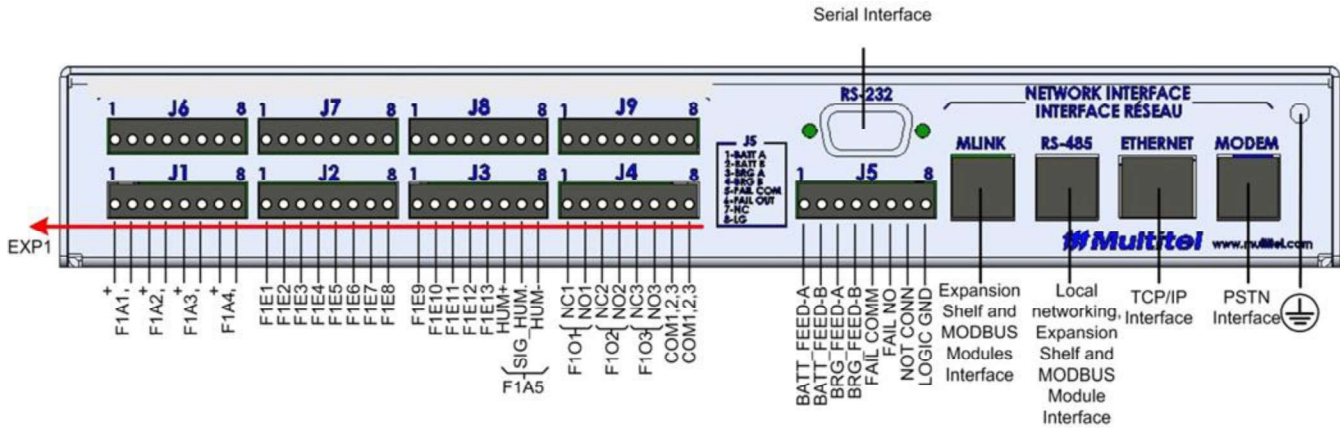


Figure 30 - I/O channels pin-out FUSION option EXP1-EXP2

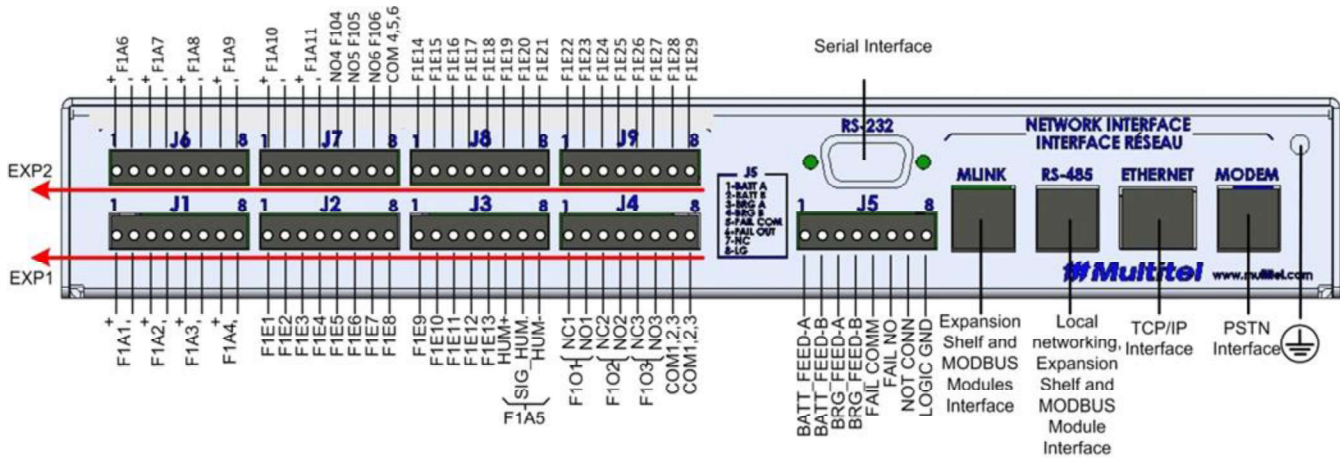


Figure 31 - I/O channels pin-out FUSION option EXP1-EXP3

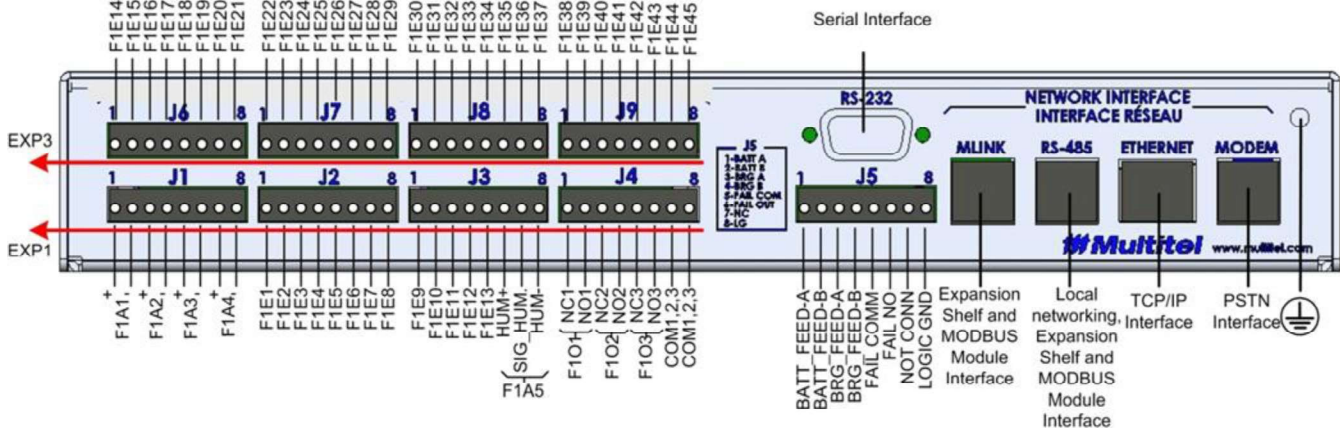


Figure 32 - I/O channels pin- out FUSION option EXP1-EXP4

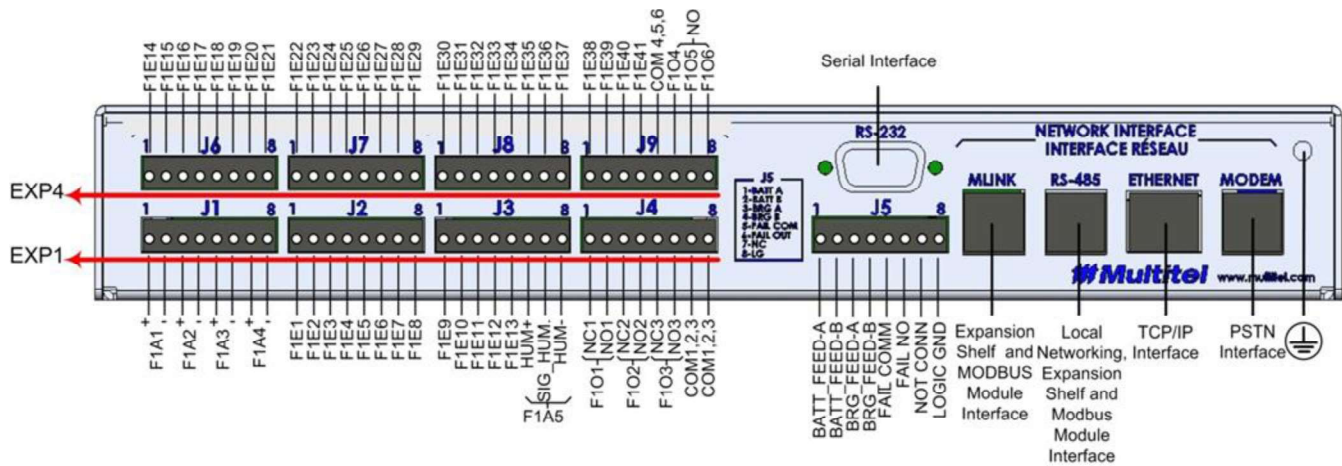


Figure 33 - I/O channels pin-out FUSION option EXP3

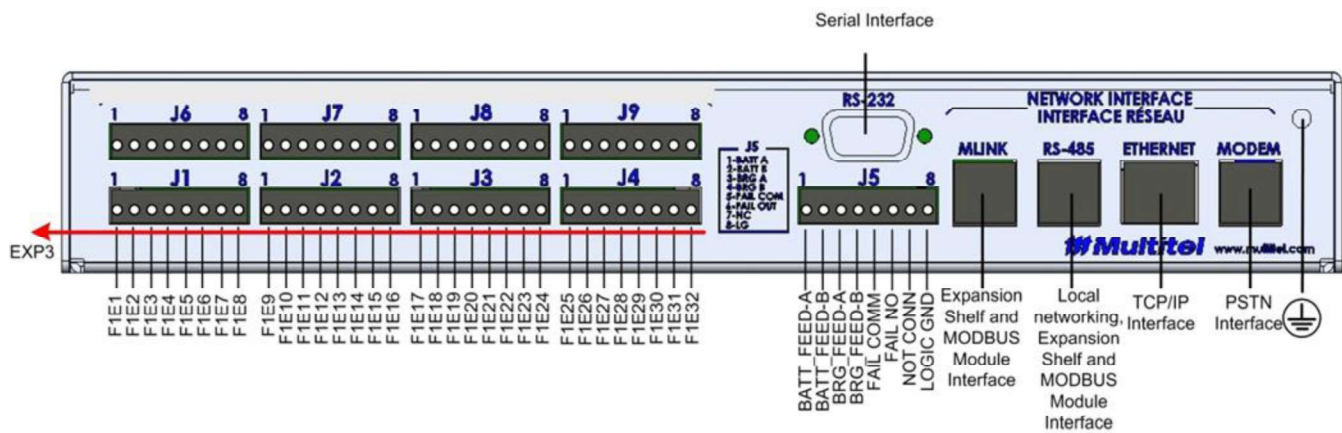


Figure 34 - I/O channels pin-out FUSION option EXP3-EXP3

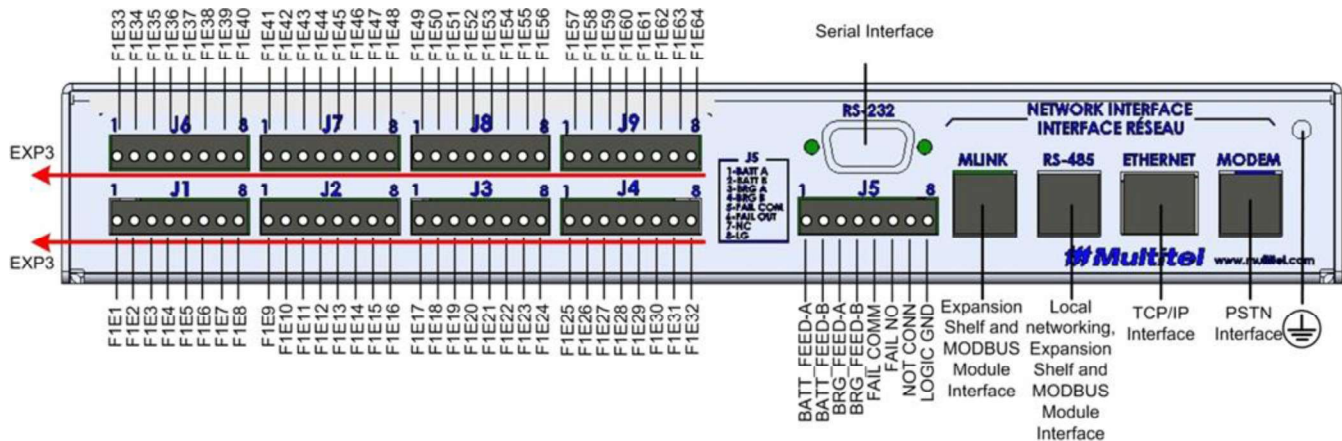


Figure 35 - I/O channels pin-out FUSION option EXP3-EXP4

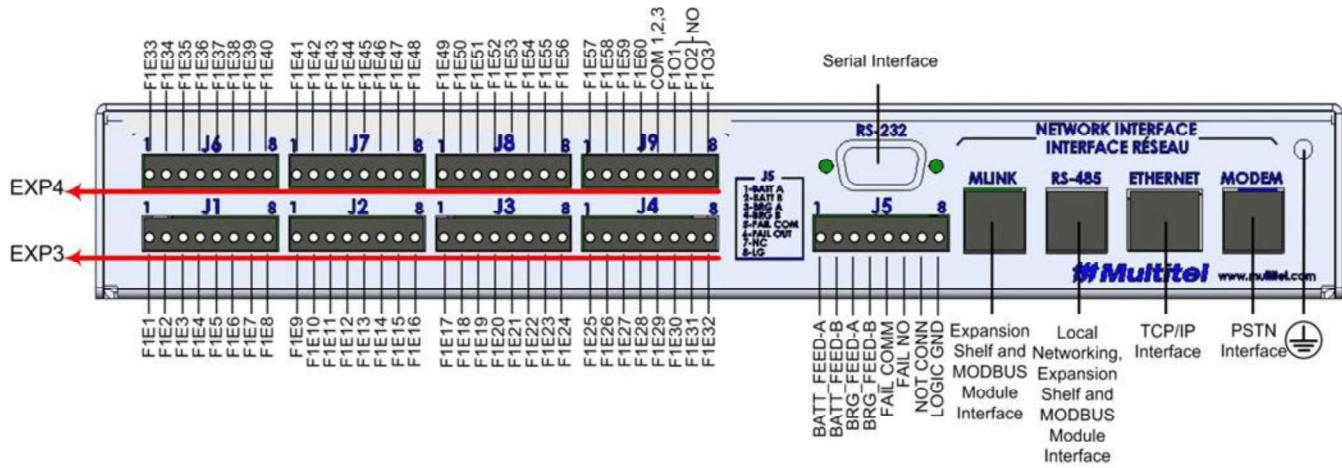


Figure 36 - I/O channels pin-out FUSION option EXP4

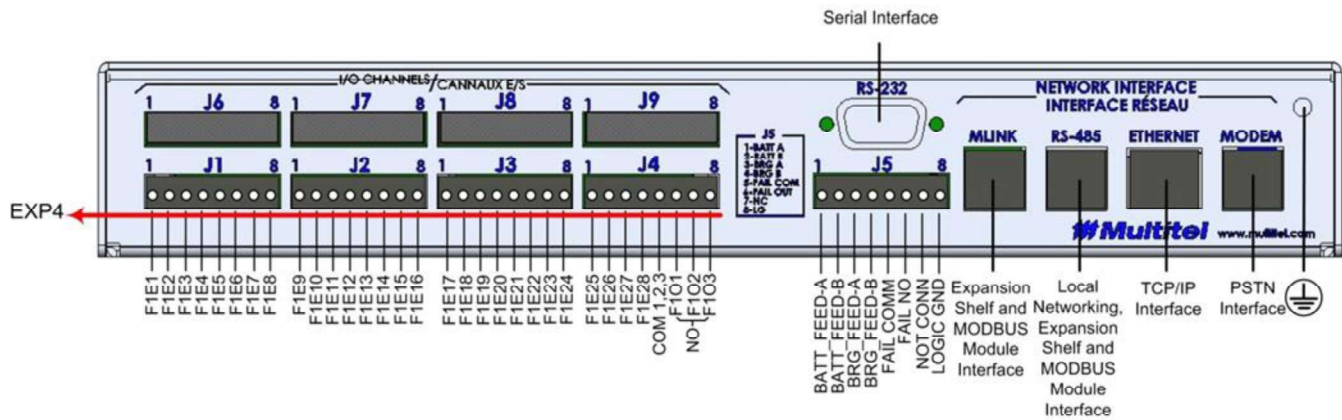


Figure 37 - I/O channels pin-out FUSION option EXP4-EXP4

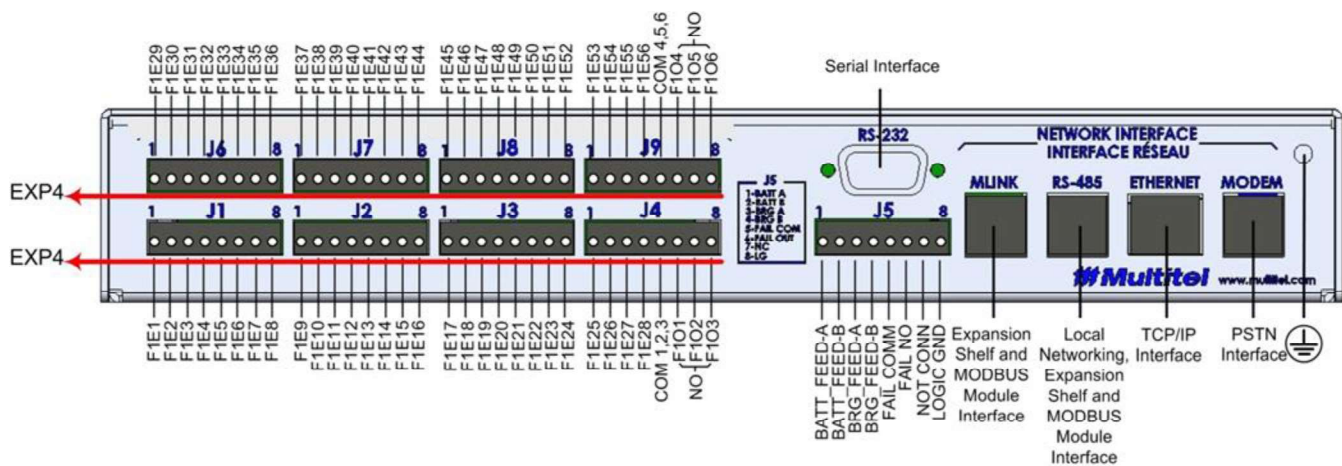


Figure 38 – Binary input channels pin-out SMX-48BI

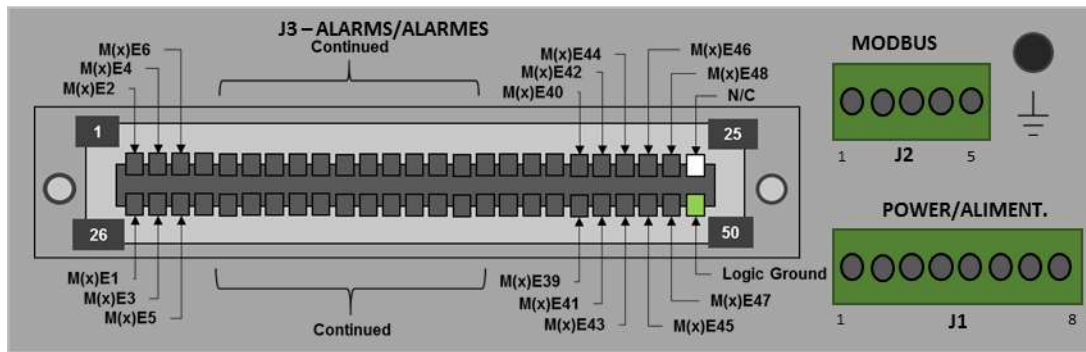
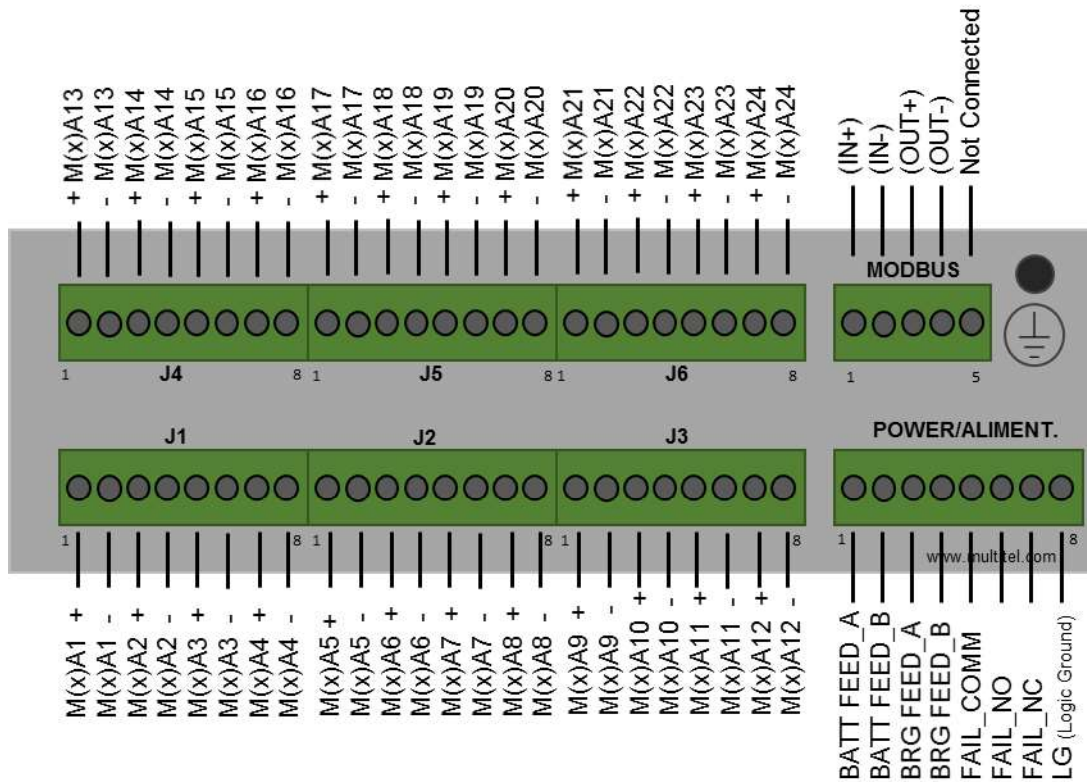


Figure 39 - Analog input channels pin-out SMX-24AI



12.3.1 Cabling and wiring distance

For each specific Analog Channel Type a specific measurement method is used. The following table enables the user to optimize results for short to long distance installations. Not following these recommendations may: damage the product, result in noisy signals or lead to false alarms. Such problems will result in technician dispatches.

Please note that our products are continuously modified to improve performance and reliability; therefore, accessories and components are subject to changes without notice. In that case, these parts or accessories are replaced by equivalent products. Contact Multitel service for the list of available accessories.

Table 93 - Maximum distances between the transducers and FUSION & SMX modules

Type of measurement	Transducer	Cabling (AWG)	Maximum Distance
DC Current ±50mV	50 mV Shunts	24,22,20 twisted pairs	100 feet
DC Voltage 10V	-----	24,22,20 twisted pairs	250 feet
DC Voltage 65V	-----	24,22,20	250 feet
Temperature	Temperature sensor Model: M-4103, M-4107	24,22,20	500 feet
Humidity	Humidity Sensor Model: M-4108 or M-4109	24,22,20	500 feet
AC Voltage 23Vrms	Step Down Transformer 1 Phase Model: M-4181, M-4182 3 Phase Model: M-4179	24,22,20	250 feet
AC Current 1.4Vrms	Current transformer	18	100 feet
Float Charging Current	FCCP Probe Model M-5601 & M-5602	24, 22, 20, twisted pairs	100 feet
Binary Input Channel	Discrete alarms	24, 26	2000 feet
Logic Ground	N/A	24, 26	2000 feet
Input Power (Typical 48Vdc)	N/A	22,20 twisted pairs	250 feet

**IMPORTANT:**

- The environment (noise, etc.) can shorten the specified distances. The use of stranded cable for analog signals is highly recommended.
- Maximum cable size depends on the connector type.
- Use appropriate fuses when specified.

12.4 WIRING ANALOG INPUT CHANNELS

FUSION and SMX-24AI can measure different types of Energy, Power and Environmental conditions using analog channels. Both share the same electronic design, therefore the following chapter applies to both the FUSION & the SMX-24AI analog channel.

FUSION can be configured with up to eleven (11) analog input channels where ten (10) are hybrid channels and one (1) is specific to humidity measurements. The SMX-24AI can be configured to measure twenty-four (24) hybrid channels. Some measurements like temperature, current and humidity require a specific transducer available only from Multitel.



IMPORTANT:

Analog channels are susceptible to noise which decreases the accuracy.

1. Limit the cabling distance between the monitored point and FUSION as per Table 93 - Maximum distances between the transducers and FUSION.
2. Use a #24AWG stranded wire or larger for each analog input channel.
3. It is important to ensure that the polarity is correct when wiring analog channels: 0-65Vdc, 0-10Vdc and TEMP.

Each hybrid analog input channel has a different user programmable front end. There are five different front ends that match the type of transducers or measurements required. Once a front end is selected the range of the analog input channels is configured (e.g. 0-65Vdc front end provides a measurement range of 0 to 65 Volts).

A linear scale value must be specified for each analog input channel in order to map the input signal. Some front ends like 65Vdc and 10Vdc are auto adjusted to 65 and 10 respectively as they are mapped directly. Some front ends like: TEMP, humidity, +/-50mV Shunts, 23Vrms, 1.4Vrms must be mapped according to the transducer rated capacity.

Table 94 – FUSION and SMX-24AI typical scaling values

Front end	Transducer	Scale value
65Vdc	Not applicable (+/- 65Vdc for the SMX-24AI)	65
23Vrms	SDTA-01 240V	2680
	SDTA-02 240V/600V	2680/6700
	Current Transducer (0-50Aac)	595
1.4Vrms	Current Transducer (0-100Aac)	1189
	Current Transducer (0-200Aac)	2378
	Current Transducer (0-400Aac)	4757
	Current Transducer (0-600Aac)	7135
	Current Transducer (0-1500Aac)	17835
	Current Transducer (0-2000Aac)	23783
10Vdc	Hall effect transducer, liquid level, etc...	CT range, tank size, etc...
10Vdc with 0-4Vdc Split Core Current Transducer.	DC Current Transducer (±50A)	125
	DC Current Transducer (±100A)	250
	DC Current Transducer (±250A)	625
	DC Current Transducer (±500A)	1250
Temp	Temperature Probes (M-4103, M-4107, M-4109)	120
Humidity	Humidity Probes (M-4109) (Does not apply to SMX-24AI)	100
+/- 50mV	Shunt	Value stamped on Shunt
	Float Charging Current Probe (M-5601)	5

12.4.1 Connecting a DC voltage input

FUSION performs measurements in differential modes. Use the 65Vdc or 10Vdc front end to measure diverse DC voltage such as -48V plant voltage, battery string voltage, mid-point string voltage, start battery voltage, etc. A voltage “V” is applied between (+) and (-) pins for each analog input channel. Isolation is used to reject any common mode voltage or noise voltage in the voltage ranges used by FUSION.

Table 95 - Connecting a DC voltage input

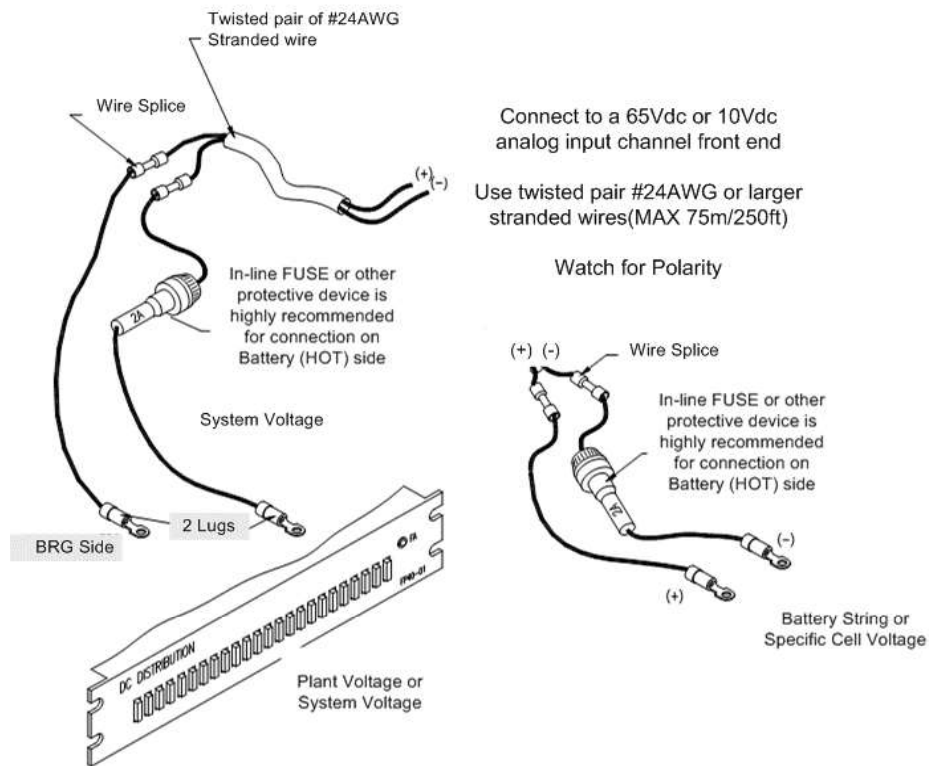
Name	Typical range	Transducer of accessory	Analog input
Start battery voltage	+ 24 Volts	None	65Vdc
System voltage	- 48 Volts	None	65Vdc
Cell voltage	2.2 Volts	None	10Vdc
Cell block voltage	12 Volts	None	65Vdc
Mid-point voltage	+/- 3 Volts	Mpp-01	10Vdc
Mid string voltage (48V)	+/- 27 Volts	None	65Vdc

- All wires must be adequately protected by distribution (1 1/3 A) or an in-line fuses (2 A)
- Stranded wires 24 AWG or larger should be used for this connection
- Connect (+) signal to a positive input channel pin and (-) signal to a negative input channel pin for all DC voltage connection



Ensure that the analog channel is assigned the proper DC voltage isolated input channel as permanent damage may occur when DC voltage is connected to other types of input channel.

Figure 40 - DC voltage measurement



12.4.2 Connecting a shunt to monitor DC current

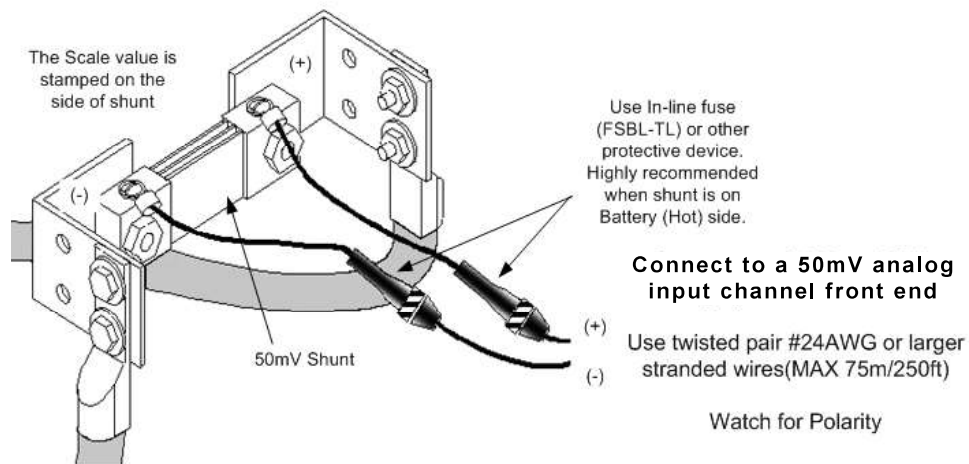
Shunts may be used to monitor: battery charge and discharge current, load current, feeder, circuit or fuse current and rectifier currents in co-location applications. DC current is widely measured using a 50mV shunt. The value stamp on the shunt corresponds to the maximum measurable current. This value is used to program the scale of the corresponding analog input channel.

- All wires must be adequately protected using ½ Amp in-line fuses when a shunt is installed on the battery side.
- Stranded wires 24 AWG or larger should be used for this connection
- Positive lead is connected to positive pin connector and negative lead is connected to negative pin connector.



Make certain the analog channel front-end is assigned to ± 50 mV.

Figure 41 - DC shunt current measurement



12.4.3 Connecting DC current transducer

Branch Circuit Monitoring on PDF or DC Distributions system can be achieved when there are no $\pm 50\text{mV}$ shunts using a Split Core Current Transducer (CT) to transform the current passing through the conductor into a low output voltage signal (0-4Vdc) safe to manipulate. The Analog Input Channel front end 0-10Vdc or $\pm 10\text{Vdc}$ should be used to measure low output voltage.

The CT is very compact, lightweight split core allowing easy installation. It has an offset voltage less than $\pm 30\text{mV}$. It is $\pm 1\%$ linear. It is 1% accurate at the rated current and conforms to UL 61010-1.

Table 96 - Connecting an DC current transducer

Typical range	Model part #	Analog input front end	Analog input scale
0 to 50Adc	M-4630-10-50	10Vdc	125
0 to 100Adc	M-4630-16-100	10Vdc	250
0 to 250Adc	M-4630-24-250	10Vdc	625
0 to 500Adc	M-4630-36-500	10Vdc	1250

- Open the current transformer and place the conductor inside.
- If the included eight (8) foot wire needs to be extended beyond eight (8) feet connect the output signal (black and white lead) using twisted pair of #24 AWG stranded wire.



Ensure that the proper analog input front end (10Vdc) is set before connecting the input signal. An improper signal may permanently damage the equipment.

Figure 42 – Split Core DC current measurements



12.4.4 Connecting temperature probes

Many temperature measurements can be performed: Battery (cell) temperature, ambient temperature, outside temperature, duct temperature, room temperature, etc. However the temperature measurement can only be performed using specific temperature probes available from Multitel. They are ideal for remote installation as they are immune to voltage drop and noise over long distances due to their high impedance.

Available probes depending on the type of temperature measurement:



Ambient temperature
and humidity
M-4109
(Terminal inside)



Ambient temperature
M-4107-50 or M-4107-100
(15m/50' or 33m/100' cable)



Ambient
temperature
M-4107
(Terminal inside)



Outside
Temperature
M-4115
(33m/100' cable)



Battery Temperature
M-4103 – 3m/10' cable
M-4104 – 8m/25' cable

Table 97 - Connecting temperature probes

Type of measurement	Probe model	Typical range	Front end (scale)
VRLA cell temperature	M-4103	-25 to 105°C	Temp (120)
Ambient temperature	M-4107	-25 to 105°C	Temp (120)
Surface temperature	M-4111	-25 to 105°C	Temp (120)
Outside temperature	M-4115	-25 to 105°C	Temp (120)
Ambient temperature & humidity	M-4109	-25 to 105°C	Temp (120)

Add -50 or -100 to the above part number to get either 15m (50') or 22m (100') longer cabling. The M-4102 Ambient temperature probe can be replaced with the M-4107 probe using the same cabling.

Please note that our products are continuously modified to improve performance and reliability; therefore, probes are subject to changes without notice. In that case, these probes are replaced by equivalent products. Contact Multitel service for the list of available accessories.

Temperature sensors are easy to install:

1. Choose a location related to close to the device (stay away from unwanted heat sources which will impact the measurement).
2. Use a stranded wire size #24 to #20 over a maximum distance of 150m/500' and connect to the specified analog channel.
 - a. If pre-wired: connect the red wire to the positive pin and the black wire to the negative pin of the same analog input.
 - b. If terminal: connect the "+" to the positive pin, the "-" pin to the negative pin of the same analog input.
3. To prevent strain on the cable fasten the cable to the adhesive cable clamp.
4. Perform the configuration of the analog input channel (refer to the user manual of the monitoring device).
5. Configure alarm thresholds as needed for the application.

Figure 43 - Ambient temperature measurement (M-4107)

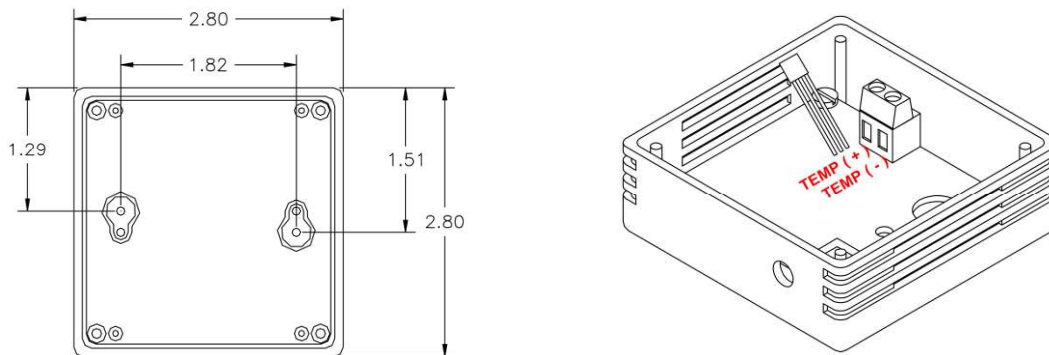
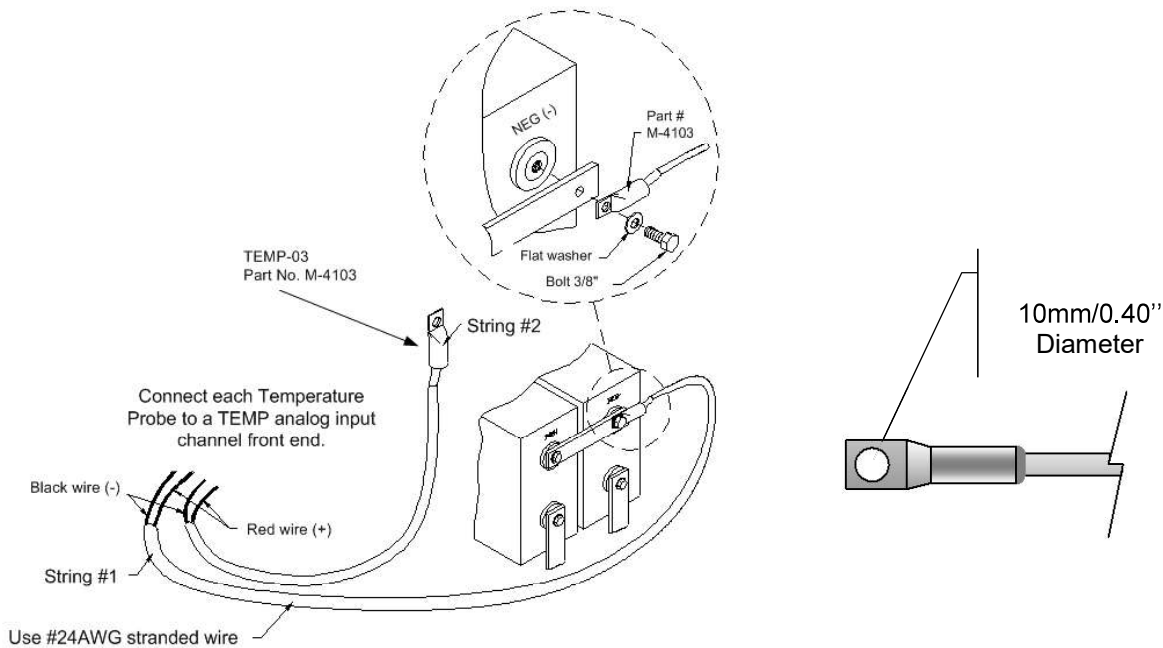
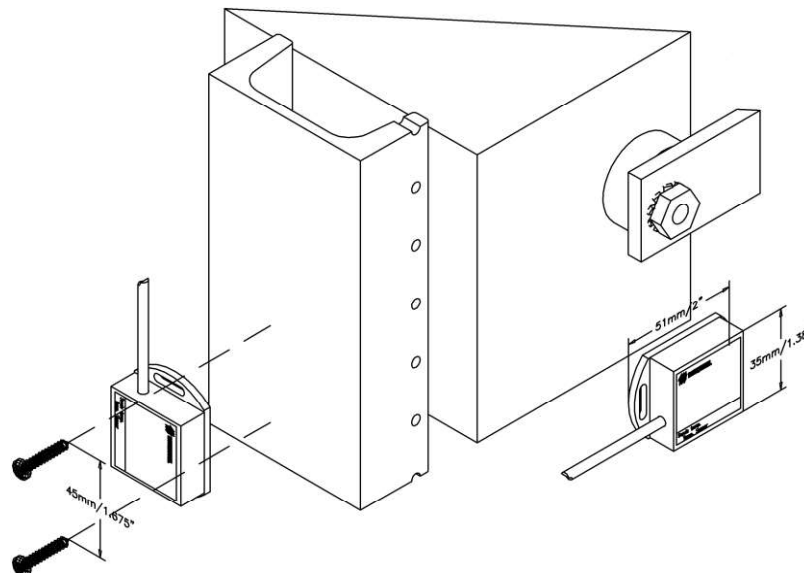


Figure 44 - Sealed battery temperature measurement (M-4103)



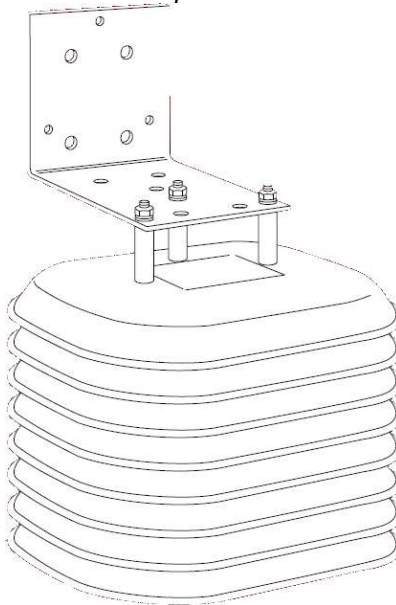
Valve Regulated Lead Acid VRLA (VRLA) battery cells have a screw-in type post. This post type is mostly used in the telecommunications industry.

Figure 45 - Surface temperature measurement (M-4111)



Note: Do not use this probe to measure outside temperature. For good adhesion the surface must be clean and dry. It should be cleaned prior to installation to eliminate surface grease or oil.

Figure 46 - Exterior temperature measurement (M-4115)



- Probe cable should be run inside ductwork for protection.
- Connect the probe black wire to the negative pin and the red wire to the positive pin of the connector.

12.4.5 Connecting a humidity sensor

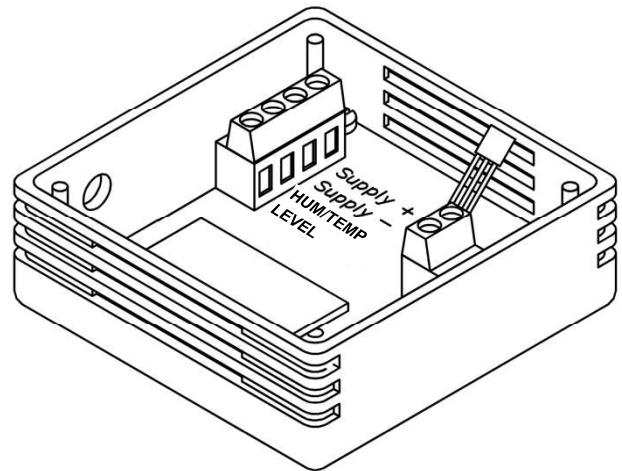
Relative humidity measurement is made possible using a specific sensor that is available from Multitel. The Sensor should be installed away from cold or heat sources such as ventilators or rectifier cooling fans. The sensor is not affected by repeated condensation and provides high reliability and long term stability.

Name	Typical range	Transducer	Typical input channel
Ambient temperature & Relative Humidity	0 to 100%	M-4109	J3 pin 6,7 & 8 onto EXP1

- Open the humidity sensor by gently pulling the bottom cover away from the top cover.
- Strip approximately 4 inches of outer jacket from the 4 conductor stranded cables #22 or #24.
- A 6 conductor cable will be required to connect the TEMP sensor.
- Connect each conductor to the proper connector screw. (See figure below)
- Wrap all four (Or six) wires once around the upper-right plastic post inside the humidity sensor case. This will transfer cable stress the post instead of to the connector. (See figure below.)
- Mount the cover on the mounting surface (wall or other) and snap the top cover back into place.
- Connect the temperature probe black wire to the negative pin connector and the red wire (+) to the positive pin connector.

Figure 47 - Humidity sensor (M-4109)

PINOUT SENSOR	PINOUT FUSION
SUPPLY -	HUM - (J3-8 on EXP1)
SUPPLY +	HUM + (J3-6 on EXP1)
LEVEL	SIG_HUM (J3-7 on EXP1)
HUM/TEMP(NOT USED)	
TEMP +	FxAy +
TEMP -	FxAy -



12.4.6 Connecting AC current transducer

Commercial AC current monitoring is made possible using Current Transformers (CT) to transform the current passing through the conductor into a low output voltage (0.333 V) safe to manipulate. The Analog Input Channel front end 1.4Vrms should be used to measure low output voltage.

The voltage circuit (120 to 600Vac) has no impact on measurements. As the output signal is low a Current Transformer scaled according to the current typical value to be measured is recommended. The CT accuracy is 1% (i.e. between 10 and 100% of the specified interval)

Table 98 - Connecting an AC current transducer

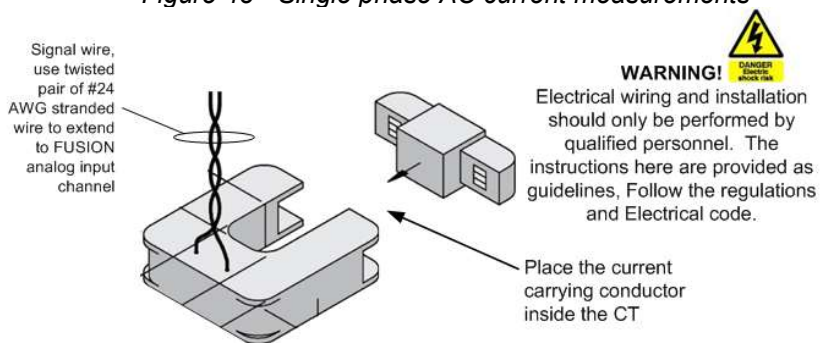
Typical range	Model part #	Analog input front end	Analog input scale
0 to 50Aac	M-4320-50	1.4Vrms	595
0 to 100Aac	M-4320-100	1.4Vrms	1189
0 to 200Aac	M-4320-200	1.4Vrms	2378
0 to 400Aac	M-4320-400	1.4Vrms	4757
0 to 600Aac	M-4320-600	1.4Vrms	7135
0 to 1500Aac	M-4320-1500	1.4Vrms	17835
0 to 2000Aac	M-4320-2000	1.4Vrms	23783

- Open the current transformer and place the conductor inside.
- If the included eight (8) foot wire needs to be extended beyond eight (8) feet connect the output signal (black and white lead) using twisted pair of #18 AWG stranded wire.



Ensure that that the proper analog input front end (1.4Vrms) is set before connecting the input signal. An improper signal may permanently damage the equipment.

Figure 48 - Single phase AC current measurements



12.4.7 Connecting AC voltage transformer

Commercial AC voltage monitoring is made possible using a Step-Down Transformer Adapter (SDTA) to lower the input voltage to a low output voltage (17V or 12V) safe to manipulate. The measure is defined using true RMS algorithms to provide an excellent ratio between the actual value and the measurement.

Table 99 - Connecting an AC voltage transformer

Input voltage range	Typical range	Transducer accessory	Typical input channel
Single phase	0-240Vac	SDTA-01 240Vac	One 23Vrms
Three (3) phases	0-240Vac	SDTA-02 240Vac	Three 23Vrms
Three (3) phases	0-600Vac	SDTA-02 600Vac	Three 23Vrms

- Connect each phase (star or delta) to the SDTA, using Teck-90 14-2 cable.
- Connect the FRAME GROUND to the SDTA using #14 AWG cable.
- Connect the "OUTPUT" of the SDTA to the corresponding analog input channel on FUSION using #24 AWG stranded wire or larger.

Ensure the selected Hybrid Analog Input Channels have the 23Vrms front end programmed. Improper signals may permanently damage the equipment.

Figure 49 - Single phase 120 volt measurement

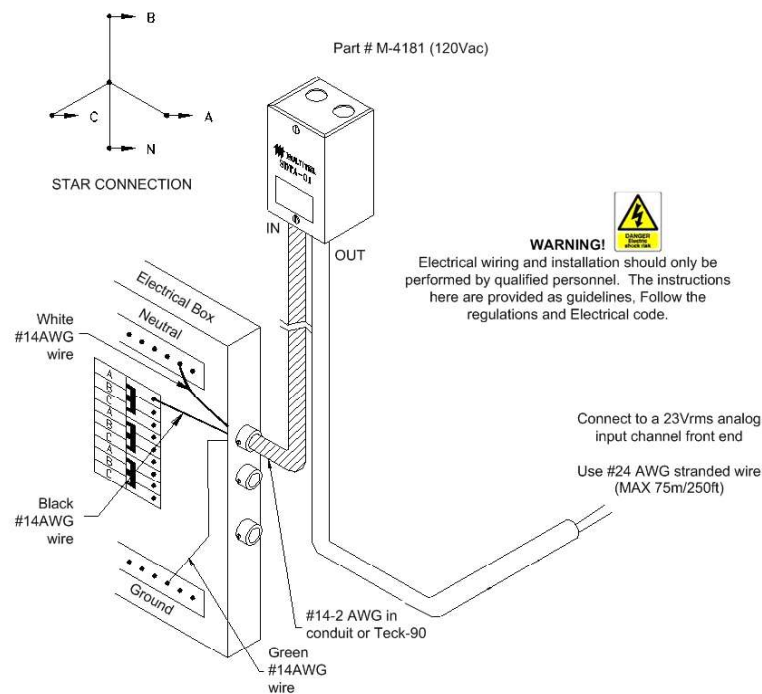
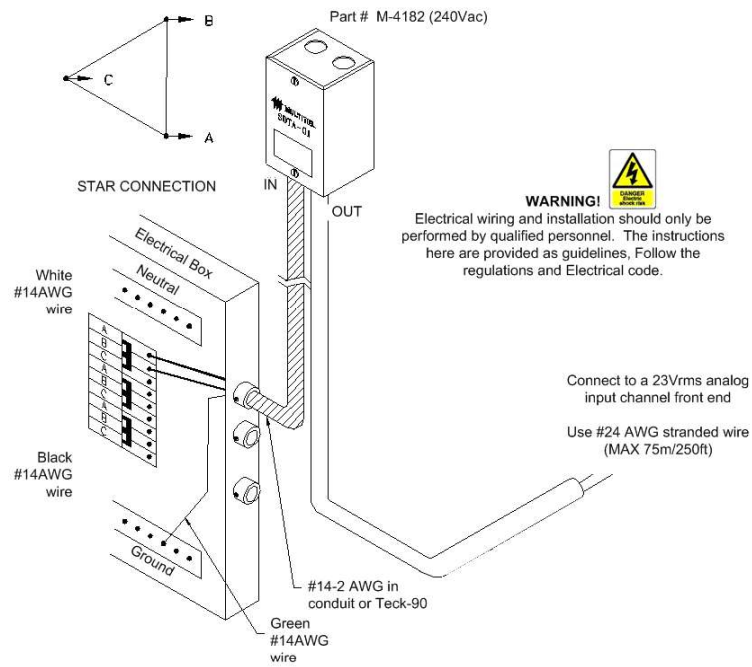


Figure 50 - Single phase 240 volt measurement



12.5 WIRING BINARY INPUT CHANNELS (DRY CONTACTS)

FUSION and SMX-48BI can monitor equipment failures, discrete alarms or status changes using Binary Input channels. Each channel can detect a GROUND or BATTERY signal across the logic ground reference. (See [section 4.6 BINARY INPUT CHANNELS \(EXP1, EXP2, EXP3, EXP4 and SMX-48BI](#). Each Binary Input Channel is individually wired to the corresponding connector's pin with # 22, #24 or #26 AWG wires.

It is preferable to wire each individual alarm to a single telemetry system. However, if you want to connect the discrete alarms in parallel to another system, for example: in a transition phase between an old system and FUSION; it is your responsibility to verify carefully with the FUSION's binary input channel detection circuit ([Figure 51 -](#)). Even if you insert a diode to isolate the binary input channel detection circuit, you still have to verify that you are not interfering with the FUSION's input detection circuit to prevent false alarms. Each situation is different and Multitel cannot guaranty that the input impedance from third party equipment would be compatible with the FUSION, even with a diode. So, in case of uncertainty, Multitel offers its services to help clarify the situation.

Figure 51 - Binary Input channel detection circuit

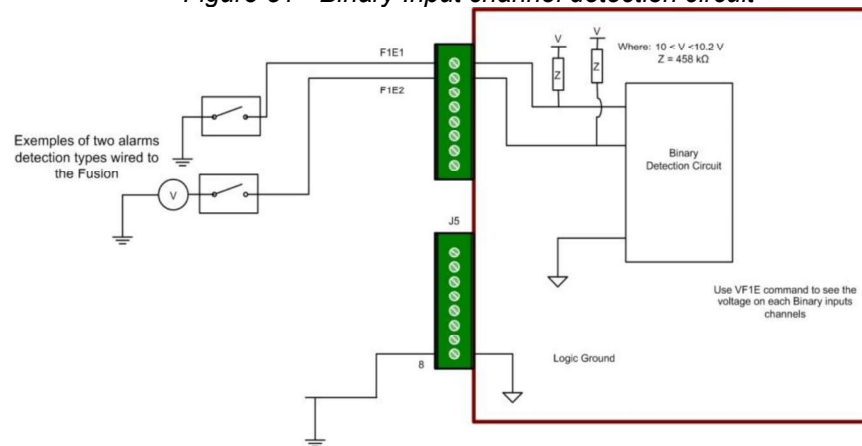
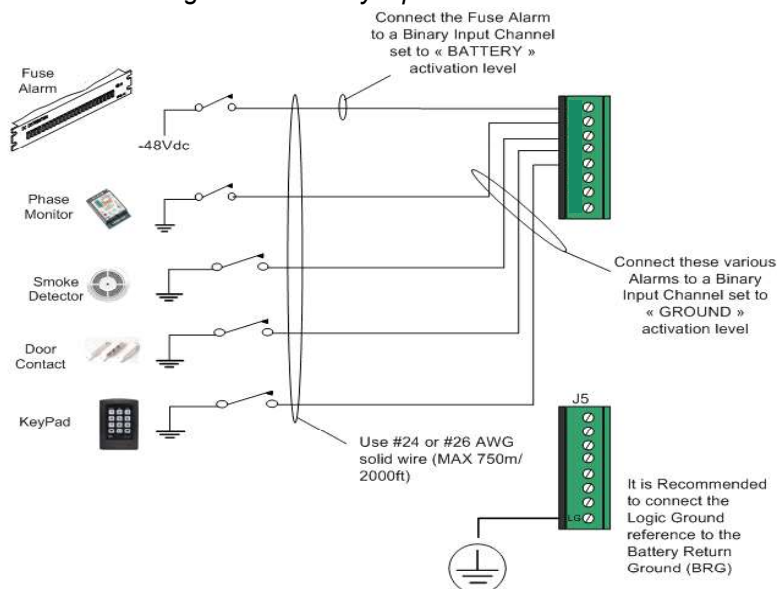


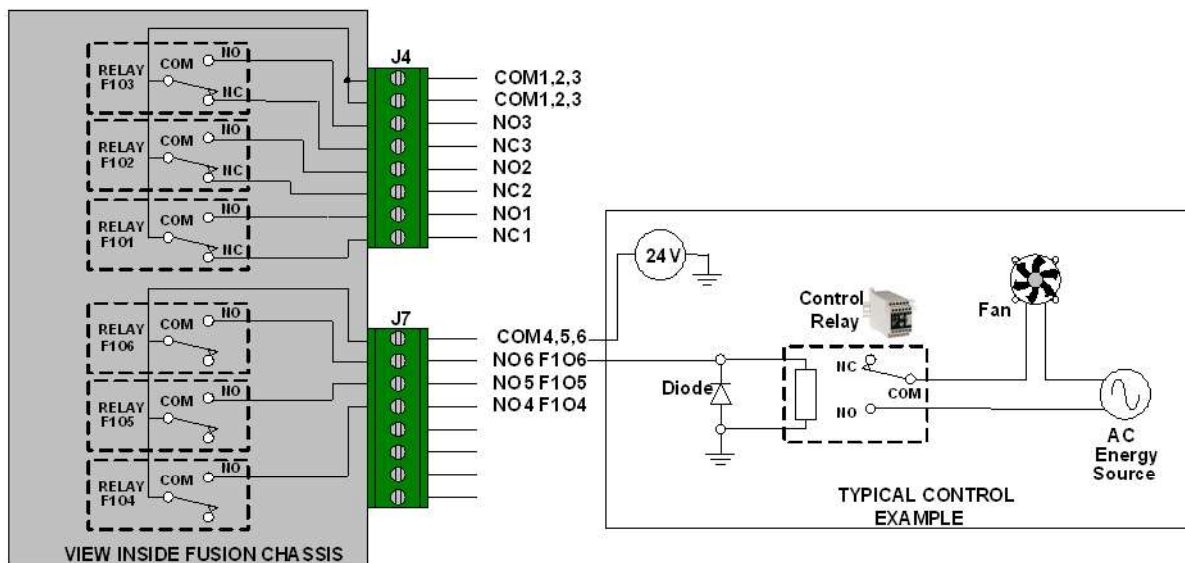
Figure 52 - Binary input channel connections



12.6 WIRING BINARY OUTPUT CHANNELS (RELAY)

FUSION can control the operation of micro-relays to start/stop the operation of systems such as generators and HVAC systems. The relay may also be used to issue discrete alarms for local telemetry systems. A total of 6 relays are available. There are three (3) relays providing a FORM C contact and three (3) relays providing a FORM A contact. All Relay Common pins are bound together in order to reduce installation time. A Battery Return Ground signal is recommended for issuing discrete alarms. When FUSION is used to control operation of HVAC vents, louvers or motors an external control relay must be used to handle the high power. A diode must be used to eliminate the high reverse voltage in the coils or solenoids (inductive load). A ferrite bead may also be used to eliminate induction noise which can cause a system reset. (See figure below)

Figure 53 - Typical relay output channel connection (EXP1-EXP2)

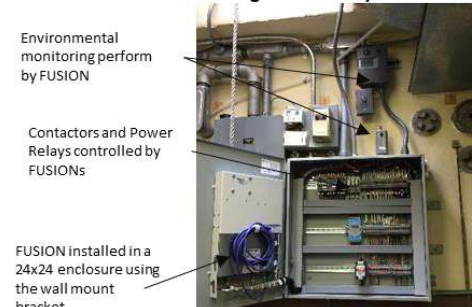


12.7 BUILDING AUTOMATION

FUSION can control the operation of HVAC system to control the environmental condition is a telecom site, it can also trigger the monthly test of Generators and can also act as the Solar PV controller. The combination of FUSION Binary Output channels (relay) and its logical and automation software feature set make it an ideal tool to upgrade your existing legacy controls.

Following is an example of a FUSION monitoring and controlling the environmental conditions in a CEV site. A CEV, Controlled Environmental Vault is a underground telecom site.

FUSION CEV is applied to monitor and control HVAC in an underground facility

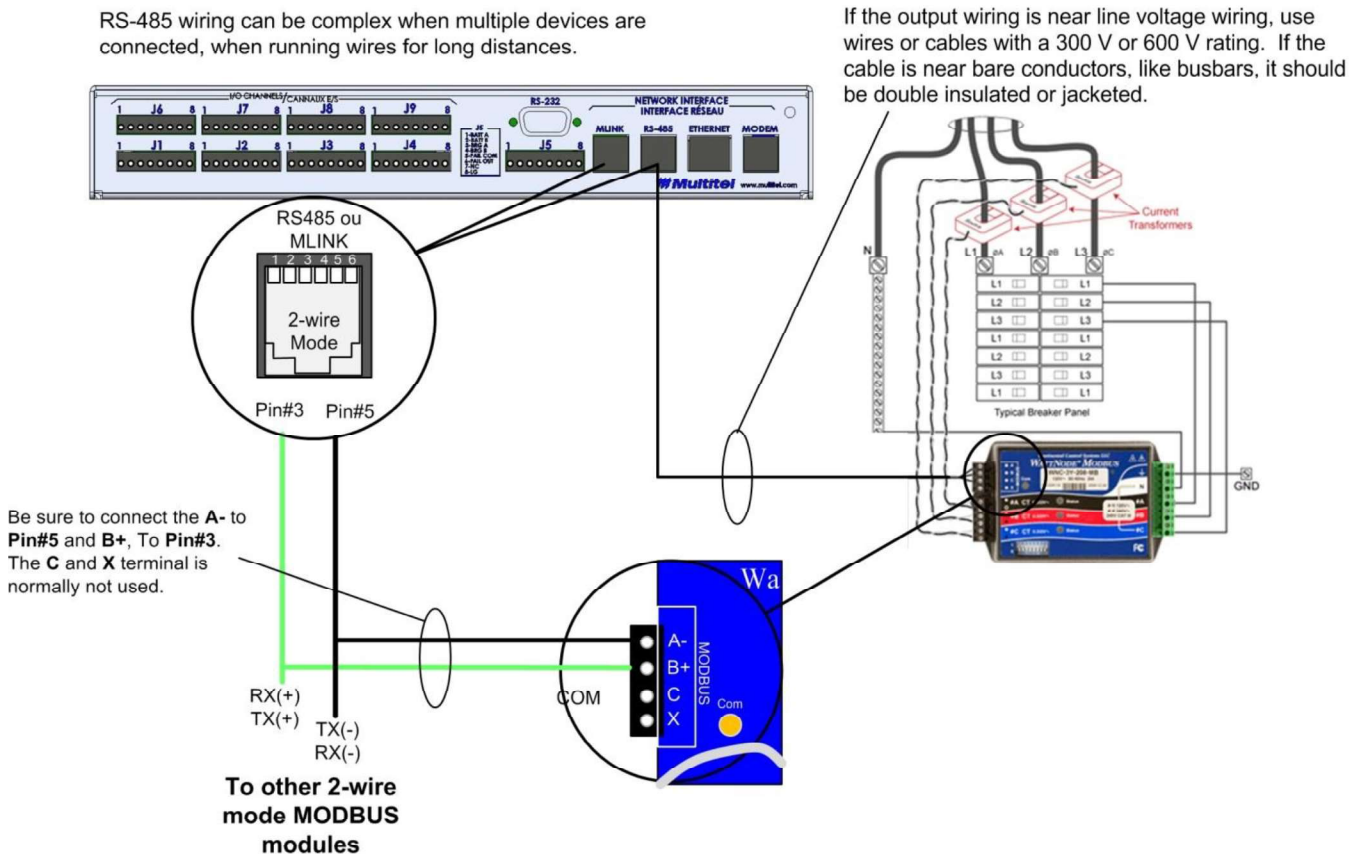


12.8 WIRING MODBUS MODULES TO THE FUSION

FUSION can support up to 64 MODBUS modules composed of "Generic modules" or "SMX modules". The "Generic modules" are third party modules commercially available and technical specifications vary from one

vendor to another. Please refer to the vendor's technical documentation for installation, wiring and MODBUS registry instructions. The SMX modules are supplied by Multitel and do not require MODBUS registry configuration; installation and wiring details are described in section 8.1.

Figure 54 - Two wire RS-485 Subnet



RS-485 wiring can be complex when multiple devices are connected. When running wires for long distances, RS-485 networks should always be wired in a bus (or daisy-chain) configuration. The bus should start at the FUSION and then be run to each meter in turn. Branches and “home-run” wiring (i.e. each module is wired back to FUSION individually) should be avoided. For best results, especially when running longer distances, shielded twisted-pair cable should be used to prevent interference. **NB: Shielded cable should be connected to ground at one end only.**

Table 100 - Recommended RS-485 cabling

Manufacturer	Part number	AWG	Pairs	Shielded	Impedance	Insulation
Superior Essex	CMR 18-042-33	24	2	No	100 ohms	300 V
Belden	9841	24	1	Yes	120 ohms	300 V
Belden	9842	24	2	Yes	120 ohms	300 V
many	CAT 5,5e	24	4	Optional	100 ohms	300 V
many	CAT 6	23 or 24	4	Optional	100 ohms	300 V

Multitel has developed a connector module for MODBUS connection to avoid using RJ-12 connectors refer to section 10.3.1 for information on the connector module.

12.9 FUSION START-UP

Before the FUSION is powered up check all grounding, power and I/O connections.

Place the J5 connector and insert the correct fuse. The J5 connector (located on the back panel) provides A&B feed, logic ground reference and Unit Fail Alarm Relay contact.

When FUSION starts a quick self-test sequence will be performed.

FUSION will then boot up in this order:

1. Booting and automatic testing of the hardware and software
2. Loading of the software and configuration parameters
3. FUSION enters Normal Operation

In Step 1 the parameters of the system (as well as the parameters for each Expansion shelf's I/O card software version) are verified (if present). During this procedure the I/O card failure LED indicators will display yellow and audible alarms may activate. If no problems occur during step 1 the software is then loaded. When an Expansion Shelf is present FUSION will transfer the software to all the I/O cards. This may take a few seconds. During this procedure the FUSION Power/Fail LED indicator will display green while the I/O card LED will display yellow. If no problems occur during step 2 the system will enter normal operation mode. At this point all LED indicators will display green. If any of the indicators does not display green refer to section [13.2 TROUBLESHOOTING](#).

12.9.1 Installation checklist

FUSION installation can be tested using this checklist or the engineering notes provided by engineering personnel.

- Are the frame grounds connected?
- Are both "A" and "B" feeds powered?
- Are there any bare ended power cables?
- Are there any loose cables and are all cables attached or tie-wrapped together?
- Have all mounting screws been tightened?
- Is the FUSION POWER/FAIL LED on the front panel solid green?
- If SMX module are networked with the FUSION are all SMX module power/fail LEDs solid green?
- If I/O cards are present are all I/O cards fail LEDs solid green?
- Are the cable designations clear and self-explanatory?
- Is the alarm LED designation on the front panel completed? (OPTIONAL)
- Are the unit IP address and/or phone number labeled?
- Have the distribution fuse locations been assigned and designated?
- Are all measurement readings calibrated?
- Is the polarity for each input signal correct?

12.9.2 System operation checklist

System operation must be checked in order to provide users with true and valuable data. The following checklist should be used to validate that each function is operating properly:

- Has the system date and time adjusted correctly?
- Are the appropriate passwords programmed correctly?
- Has the site name configured as the FUSION NAME?
- Is each analog input channel reading correct?
- Has each binary input channel been correctly activated?
- Is each discrete alarm (relay output) generating an alarm at the local alarm system?
- Is each control point (relay output) starting and stopping the peripheral accordingly?
- Is each callout operating accordingly?
- Are SNMP traps being received by the SNMP Manager?
- Is each threshold activating accordingly?
- Is each configured alarm being received at the Surveillance Center?
- Are all system alarms cleared? (Use the "?" command).
- Is the Modem/Ethernet port answering and communicating correctly?
- Does the front panel LED operate as required?



Before leaving the site ensure that the CD ROM is stored close to the FUSION device and that access to the device and alarm reception at the surveillance center is configured and functioning correctly.

13 . MAINTENANCE

13.1 CALIBRATION

All analog measurements performed by the FUSION or SMX-24AI may be software calibrated from only the Command Line Interface. Regardless of the type of analog Front End, calibration adjustments are performed to compensate for errors in the offset, gain and linearity of FUSION or SMX-24AI signal processing circuits.

Every FUSION and SMX-24AI module leave the factory fully calibrated. The fusion calibration report is available in the « Note file » under the « System information » tab of your fusion device. These values are not defined as default values in the system. (I.e., if calibration values are changed is it not possible to enable the system to automatically revert to the original factory settings) Potentiometers are not used to adjust any calibration values. All analog channels are adjusted using the software. If you need the SMX-24AI calibration report or If you lose the Fusion factory calibration values, please contact your Multitel customer service.

Before to start, the calibration of analog channels should only be performed by qualified personnel. Every FUSION and SMX-24AI module leave the factory fully calibrated. Thus, it is uncommon to want to perform a calibration for a measurement which is not as expected. Calibration should be use to correct small differences between the read signal and input signal. If the difference is too large, before to calibrate, it is recommended to verify the following in order to make certain the need for calibration is required:

1. Check the analog input configuration, make sure the front-end is selected
2. Check the scaling value, it should match the recommended value set forth in the following table.
3. Check the wiring, do you have the same value at the measurement point as at the I/O connection point on the FUSION or SMX-24AI module? the wiring length may have an impact on the value.
4. Is the measurements, probes or sensor wired to the proper terminal block pins?
5. Is the probe or sensor defective, wired correctly, powered correctly, located in a area where the expected value and real value differs?
6. Is the reference value coming from a calibrated device and/or in good working condition?
7. Are you operating the FUSION or SMX-24AI at elevated temperatures or harsh environmental conditions?

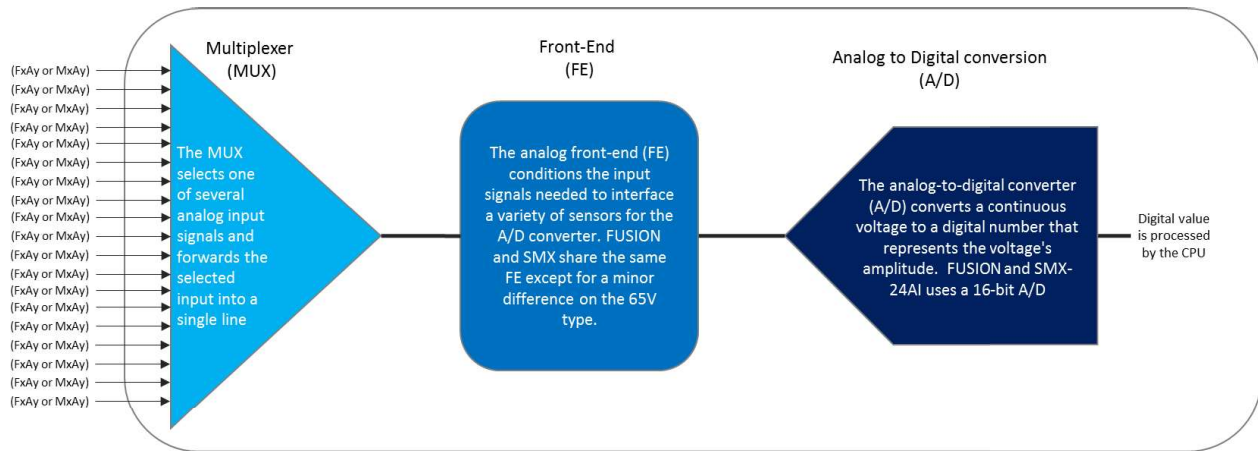
Purpose and Scope

The FUSION and SMX-24AI analog input channel are designed to provide an excellent measurement quality over many years to come, there are no calibration interval requirements. Basically, the purpose of calibration is for maintaining the quality of measurement as well as to ensure the proper working of particular instrument. For more detailed information on the I/O channel specifications, go to [specifications chapter 10](#).

A standard calibration process should include the entire measurement chain, from the sensor to the signal processing circuit. The calibration process herein is performed by software using Zero and Gain value to compensate the outputted value by the FUSION and SMX-24AI signal processing circuits. See the figure below.

The software calibration process is a channel related process. The modified Zero and Gain compensation values will impact all analog input channels configured to the front-end being calibrated. Therefore it is recommended to calibrate channels on a required basis.

Figure 556 – FUSION and SMX-24AI signal processing circuit

**Tools required for calibration:**

- 3½ digit multi-meter or better.
- ½ digit clamp-on ammeter.
- Laptop computer using a direct RS-232 cable, USB cable or Ethernet cable.
- Laptop computer equipped with a VT-100 compatible terminal software such (Hyperterminal, Putty, etc..)
- FUSION user manual

Table 101 – Scaling value for analog front end types

Front end	Transducer	Scale value
0-65Vdc (FUSION only)	Not applicable	65
+/-65Vdc (SMX-24AI only)	Not applicable	65
23Vrms	SDTA-01 240Vac	2680
	SDTA-02 240Vac/600Vac	2680/6700
1.4Vrms	Current Transducer (0-50Aac)	595
	Current Transducer (0-100Aac)	1189
	Current Transducer (0-200Aac)	2378
	Current Transducer (0-400Aac)	4757
	Current Transducer (0-600Aac)	7135
	Current Transducer (0-1500Aac)	17835
	Current Transducer (0-2000Aac)	23783
10Vdc	Hall Effect Transducer, Liquid sensors, etc...	10 or sensor's measuring range
Temp	Temperature Probes	120
Humidity	Humidity Probes (M-4109) (Does not apply to SMX-24AI)	100
+/-50mV	50 Shunts	Value stamped on shunt
	Float Charging Current Probe (M-5601)	5

13.1.1 FUSION analog step-by-step calibration procedure (EXP1 & EXP2)

The following calibration step-by-step approach works for the following front end. Before performing any channel calibration, check to see the analog channel scale is adjusted according to the specific Front End type. See above table.

- 0 - 65Vdc;
- 0 - 10Vdc;
- $\pm 50\text{mV}$;
- Temp (A Multitel temperature probe is required or TCC-01);
- 1.4Vrms;
- 23Vrms.

The FUSION software calibration is performed on a selected channel basis, but in reality the modification of the Zero and Gain compensation value impacts the Front End. Thus every channel configured with that Front End will also be affected.

Use the “**CALIBRATION**” command to adjust the “zero” and “gain” values for each analog channel. The following procedure can be performed for each channel type. For more detailed information on the Command Line Interface, go to [the section 4.2](#). The calibration menu differs between the FUSION analog channel and SMX-24AI, however the process is the same.

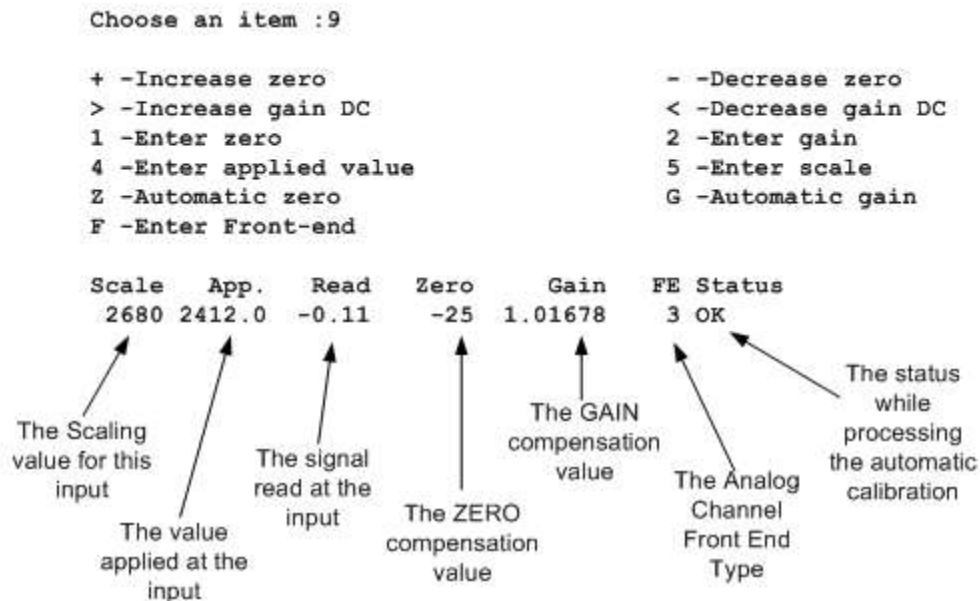
>Calibration

1-analog fusion (FxAy)

2-SMX-24AI (MxAy)

Choose an item :1

Figure 567 - Calibration menu for FUSION analog channels



To calibrate the Zero:

1. Remove the input signal and short circuit the 2 pins for the specific input channel you are calibrating.
2. Enter the applied value, should be "0.00"
 - a. For FUSION analog, press "4" and enter the higher end value,
3. To automatically calibrate press "Z" for the FUSION analog
4. Zero compensation value can be "fine tuned" manually by using the "+" and "-" keys until the read value is equal to "0.00"
5. Repeat if necessary,
6. When satisfied with the result, calibrate the Gain.

To calibrate the Gain:

Whenever possible, the applied input value should be near full scale for the specific front end.

1. Enter the applied value, should be at least 75% of full scale for optimal results,
 - a. For FUSION analog, press "4" and enter the higher end value,
2. To adjust automatically the gain compensation value, press "G" for the FUSION analog
3. To "fine tune" the Gain compensation value manually, press the "<" and ">" keys.
4. For 1.4V Front End, whenever possible, validate measurements with different CT's and scale values.
5. If the applied values for the channel correspond to the manually measured values the channel has been calibrated correctly. Proceed to the next channel or Front End type.

*For the 1.4Vrms front end, it is recommended to validate the calibration with different CT's and according scale values, Ex. Using 50A CTs and a 200A CTs.

13.1.2 Calibrating the humidity channel (FUSION only, F1A5)

A voltage calibrator or precise voltage injection device is required for this task. (Connector J3 pin7 = + and pin8 = -).

Ensure that the analog channel scale is set to 100.

1. Apply 3079.75mV as the input value for the specific channel. (This number is equal to 75% of full scale).
2. Press "4" and enter the previously applied value.
3. Apply 814mV as the input value. (This value corresponds to zero).
4. For automatic adjustments, press "Z".
5. Adjusting the zero value can be done manually by using the "+" and "-" keys until the read value is equal to zero.
6. Apply 3079.75mV as the input value for the specific channel and press "G" to start the automatic adjustment.
7. To adjust the Gain value manually press the "<" and ">" keys.
8. Validate these scales: 25% = 1569.25mV, 50% = 2324.5mV and 100% = 3835mV.

If the applied values for the channel correspond to the manually measured values the channel has been calibrated correctly. Proceed to the next channel to be calibrated.

13.1.3 SMX-24AI analog step-by-step calibration procedure

The following calibration step-by-step approach works for the following front end. Before performing any channel calibration, check to see the analog channel scale is adjusted according to the specific Front End type.

- $\pm 65\text{Vdc}$;
- $\pm 10\text{Vdc}$;
- $\pm 50\text{mV}$;
- Temp (A Multitel temperature probe is required or TCC-01);
- 1.4Vrms;
- 23Vrms.

The SMX-24AI software calibration is performed on a selected channel, but in reality the modification of the Zero and Gain compensation value impacts the Front End. Thus every channel configured with that Front End will also

be affected. The process here requires that a “Applied Value #1” and “Applied value #2” be entered for the automatic process to engage.

Use the “**CALIBRATION**” command to adjust the “zero” and “gain” values for each analog channel. The following procedure can be performed for each channel type. For more detailed information on the Command Line Interface, go to [the section 4.2](#). The calibration menu differs between the FUSION analog channel and SMX-24AI, however the process is the same.

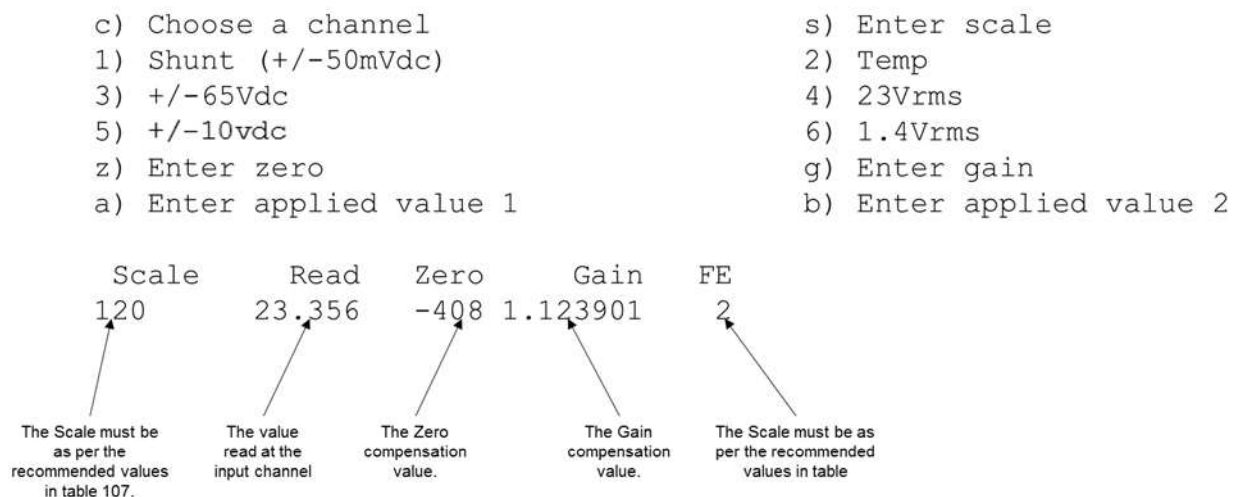
>Calibration

1–analog fusion (FxAy)

2-SMX-24AI (MxAy)

Choose an item :2

Figure 578 - Calibration menu for SMX-24AI analog channels



Ensure that the scaling value programmed for each analog channel is set according to the transducer value.

To calibrate the Zero and Gain:

1. Remove the input signal and short circuit the 2 pins for the specific input channel you are calibrating.
2. Wait for the value to stabilize, the “Read” should correspond to “0.00”
3. Press “ a) ” to enter the “applied value 1”, should be “0.00”.
4. Remove the short circuit and whenever possible apply a input signal near the “full scale” for the specific front end.
5. Press “ b) ” to enter the “applied value 2”, should be a value corresponding to at least 75% of full scale.
6. Upon entering the “applied value 2”, the automatic computation is performed and Zero and Gain compensation value are adjusted.
7. To “fine tune” the Zero and Gain compensation value manually, Press “ z) ” or “ g) ” accordingly.
8. For the 1.4Vrms Front End, it is recommended to validate the calibration with different CT’s and scale values, Ex.: Use 50A CTs and a 400A CTs.
9. If the “read” value for the channel corresponds to the manually measured values the channel has been calibrated correctly. Proceed to the next channel/Front End to be calibrated.

13.1.4 Calibration report

Use the "CALIBR" command to display a detailed calibration report for the selected item (FUSION analogs or SMX-24AI channels). This report displays programmed EXP card analog channels and Expansion Shelf I/O card analog channel calibration values.

Example of Calibration Report for FUSION analog module (FxAy).

>calibr

1-Analog fusion (FxAy)

2-SMX-24AI (MxAy)

Choose an item :1

I/O Mod	Mnemo	Status	Off	Gain	Name
1-	F1A1	En	-358	1.02869	Exterior Temperature
2-	F1A2	En	-358	1.02869	Room Temperature
3-	F1A3	En	0	0.99438	DC System Voltage
4-	F1A4	En	0	0.99438	DC System Load
5-	F1A5	En	-135	1.30688	Fuel Level
6-	F1A6	En	-358	1.02869	Temperature Lab
7-	F1A7	En	-62	0.99594	Battery Current Discharge
8-	F1A8	En	-688	1.00021	DC Fan Current
9-	F1A9	En	0	0.99438	DC Fan Control (PWM)
10-	F1A10	None	-688	1.00021	Not Programmed
11-	F1A11	None	-688	1.00021	Not Programmed

Example of Calibration Report for SMX-24AI module (MxAy).

>calibr

calibr

1-Analog fusion (FxAy)

2-SMX-24AI (MxAy)

Choose an item :2

2

#	Mnemo	State	Name
1 -	M2	Enabled	SMX-24AI

FE	Zero	Gain
Shunt (+/-50mVdc)	-191	1.0150
Temp	-408	1.1239
+/-65Vdc	5	1.0046
23Vrms	-15	0.2689
+/-10Vdc	-4	1.0085
1.4Vrms	-60	1.1134

13.2 TROUBLESHOOTING

This section provides a list of the problems that may occur and the possible causes for these problems. If a problem cannot be diagnosed and/or solved with this section contact the Multitel's Customer Service at <mailto:support@multitel.com> or at (418) 847-2255.



Before returning any defective unit Return Merchandise Authorization (RMA) arrangements should be made with the Multitel' Customer Service (CUSTOMER SERVICE CONTACT).

13.2.1 FUSION troubleshooting problems

Table 102 - Troubleshooting table

Symptom	Possible cause
POWER/FAIL indicator extinguished	Voltage is too low. The fuse for the power supply of the system is blown The connector between the FUSION card and the front panel is not inserted properly.
POWER/FAIL indicator flashing	Verify the error code for the POWER/FAIL indicator and contact Multitel Customer Services.
Active audio warning during boot sequence of the device	Normal behaviour when one of the local communication port is connected to an interface.
The MODEM does not answer when the line rings	There is a connection problem: the TIP & RING are not connected to the two (2) center pins of the RJ11 jack. <ul style="list-style-type: none"> • Verify the connections or the telephone number. • Verify that the line is connected to LINE.
The MODEM answers the call but cannot establish the communication	The remote modem is not in the ORIGINATE mode. The remote modem has failed and cannot send the ORIGINATE tone. The telephone line is noisy. The plug-in modem on the card is defective.
The communication over the MODEM is erratic.	The protocol is not properly set. See the FUSION COMPONENTS chapter. The line is noisy or shared with some other equipment. The remote modem is defective.
The Ethernet connection cannot be established.	The IP address has not been configured. The IP addressing is in error, verify with network administrator/manager.
The RS-232 link does not work	Incorrect configuration; verify if the port is enabled, the protocol and baud rate using the communication configuration function. The external equipment is DCE type and a crossed cable must be used. The external equipment is DTE type and a straight cable must be used. The serial port is defective. The external equipment is defective.
The RS-232 link works, but strange characters are generated	Verify the protocol and baud rate of FUSION and the one of the external equipment. One of the control signals is defective. Verify the cable.

Symptom	Possible cause
FUSION resets during the operation of relay output channels	<p>When FUSION is used to control the operation of large inductive loads, such as large control relay coil, solenoids, etc., the system may reset during the operation of a relay contact.</p> <p>Use external control relays or solenoids to handle the high power currents (highly recommended)</p> <p>Use diodes to eliminate the high reverse voltage when controlling the external control relay or solenoids (highly recommended)</p> <p>Use a Ferrite bead (CMT091-A) available from Multitel to eliminate noise induction on the battery return and digital ground of the FUSION.</p>
FUSION logs out when downloading a configuration file from the Web interface	Verify that the "Site/Name location" parameter in the General System Parameter function has a maximum of 16 characters.
FUSION does not read analog input channel properly, it displays: OVL+ or 0.00	<p>Verify if the channel type is programmed according to the measurement.</p> <p>Check the connection polarity at the back panel (see the INSTALLATION section).</p> <p>Verify if the signal input exceeds the channel type or measurement range.</p>

13.2.2 FUSION POWER/FAIL LED

This LED informs the user of any type of FUSION failure. This LED is located next to the USB port on the front panel. Table 90 and 91 describe possible causes and solutions for the various colours and flashing sequences of the POWER/FAIL LED.

Table 103 - LED colour troubleshooting table

Colour	Possible cause	Solution
Green	Hardware and software functional	Normal
Red	Hardware problem	Contact Multitel Customer Services.
Flashing red once	Defective Expansion Shelf I/O card(s)	Replace the peripheral card(s) or configure the card using the C[x] card configuration function.
Flashing red twice	Problem with the Front Panel	Replace the front panel.
Flashing red 3 times	Low on-board lithium battery	Replace the 3.3 V battery.
Flashing red 4 times	Memory problem	Contact Multitel Customer Services.
Flashing red 5 times	EEPROM problem	Contact Multitel Customer Services.
Flashing red 6 times	RTC problem (Real Time Clock)	Contact Multitel Customer Services.
Flashing red 7 times	Power feed A or Power feed B problem	Contact Multitel Customer Services.
Flashing red 8 times	Modem problem	Contact Multitel Customer Services.
Flashing red 9 times	Network Interface problem (problem with physical layer of Ethernet)	Contact Multitel Customer Services.
Flashing red 10 times	Fatal configuration problem.	There are fatal errors in the configuration. If this happens the configuration file is reset to default values except for communication parameters. Contact the Multitel Customer Services.

Colour	Possible cause	Solution
Flashing red 11 times	Communication or configuration problem with one of the MODBUS or SNMPget modules (wrong type of data received, or module not responding)	Verify if the module status is NA or ERR. A NA status suggests a communication problem; some parameter adjustment can be made in that case. A ERR status is related to a configuration problem. If the configuration or the communication seems correct then Contact Multitel Customer Service.
Flashing red 12 times	NTP server not available or one of the PID is not working properly	If the problem comes from the NTP check with the NTP Server Service Supplier. If the problem is from the PID, first check the PID status. If it is NA the PID is within its reference signal stabilisation time. If the status is ERR then verify the PID parameters. Even a disabled PID can trigger a fault signal.
Flashing red 13 times	Defective FUSION I/O card(s)	Contact Multitel Customer Services.
Flashing red 14 times	Modubus display unavailable	Verify connections and configuration.

13.2.3 SMX module troubleshooting

There are two LEDs located on the front panel used to indicate the SMX module status. Priority is given to a fault over a warning. Following are the error code definition and possible solution. Please do not hesitate to contact Multitel Customer Service for further technical assistance.

POWER/FAIL LED for SMX modules		
Colour	Possible cause	Solution
Green	SMX module Operational	Normal
Red	SMX module Fault	Contact Multitel Customer Services.
Flashing red once	SMX module Fault, data acquisition not working	Contact Multitel Customer Services.
Flashing red twice	SMX Fault, logic ground	Verify wiring
Flashing red 3 times	Fault not assigned	
Flashing red 4 times	Fault not assigned	
Flashing red 5 times	Fault not assigned	
Flashing red 6 times	Fault not assigned	
Flashing red 7 times	Fault not assigned	
Flashing red 8 times	Fault not assigned	
Flashing orange once	Warning, SMX FEEDA faulty	Verify power supply FEED A
Flashing orange twice	Warning, SMX FEEDB faulty	Verify power supply FEED B
Flashing orange 3 times	Warning not assigned	
Flashing orange 4 times	Warning not assigned	
Flashing orange 5 times	Warning, one or more SMX channel not functional	Verify configuration and wiring
Flashing orange 6 times	Warning, SMX system in test mode	Wait few seconds
Flashing orange 7 times	Warning, SMX configuration not received	Verify SMX module addressing
Flashing orange 8 times	Warning, SMX code executing (BOOTLOADER)	Wait few seconds

MODBUS LED for SMX modules		
Colour	Possible cause	Solution
Green	Message destined for current SMX module received and answered correctly.	Normal
Yellow	Message destined for another SMX module answer properly.	Normal
Red	Invalid message, possible TX error, bad format, function code not recognized by the SMX module.	Verify module type, SMX firmware version, address conflicts and communication speed before contacting Multitel Customer Services.

13.2.4 Expansion Shelf - I/O CARD problem (analog, event or output)

Table 104 - Expansion Shelf I/O CARD troubleshooting

Symptom	Possible cause
POWER/FAIL indicator not displayed.	The voltage is too low. The fuse for the power supply of the system is blown.
POWER/FAIL indicator flashing	Verify the error code for the POWER/FAIL indicator and contact the Multitel Customer Services.
The system does not detect an event	The event channel is not properly connected. Refer to the INSTALLATION section.
	The event signal is incompatible. Verify with a multimeter.
	The event channel is OFF, or the event card is OFF or defective. Verify the system programming.
	The triggering period of the event is too long.
The system does not control an output channel	The triggering source is not active.
	The output is improperly connected. Refer to the INSTALLATION section.
	The output channel is OFF, or the output card is OFF or defective. Verify the system programming.
	The activation/deactivation period is too long.
The system detects an erratic value on an analog channel	The channel is improperly connected. Refer to the INSTALLATION section.
	The channel is improperly configured. Verify the scale, sign and status. Measure directly at the input of the connector with a multimeter.

13.2.5 Expansion Shelf - I/O cards POWER/FAIL LED

I/O Cards located inside the Expansion Shelf have a POWER/FAIL LED. This LED informs the user on the card failure mode. The two following tables describe the possible causes and solutions for the various colours and flashing sequence of the LED.

Table 105 - I/O card POWER/FAIL LED (analog, event or output)

Colour	Possible cause	Solution
Yellow	Ongoing loading of software	Normal during booting
Green	Hardware and software functional	Normal
Flashing red once	No data received on the RS-485 link	Contact Multitel Customer Services
Flashing red twice	Converter problem	Contact Multitel Customer Services
Flashing red 3 times	Memory problem	Contact Multitel Customer Services
Flashing red 4 times	Program not available	Contact Multitel Customer Services
Flashing red 5 times	Problem with RS-485	Contact Multitel Customer Services
Flashing red 6 times	Wrong configuration	Modify configuration

Table 106 - Specific problems: Analog card FAIL LED

Colour	Possible cause	Solution
Flashing red 7 times	Timer error	Modify configuration
Flashing red 8 times	Low battery	Replace the 3.3 V Battery

13.3 MEMORY BACKUP BATTERY REPLACEMENT

Some data (e.g. battery statistics, history) are stored in two-year storage capacity memory protected against accidental erasure by means of a battery back-up. The battery life is approximately 10 years. When the battery gets low the POWER/FAIL indicator will flash red 3 times. The battery should be replaced at this point. Please Contact Multitel Customer Service for assistance with this task.

The required battery model is: CR2032.



Caution: Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to local regulations.

14 ABBREVIATIONS

AC:	Alternating Current	MAJ:	Major
ACO:	Audible Cut off	MIN:	Minor
ANSI:	American National Standard Institute	MIB:	Management Information Base
ASCII:	American Standard Code for Information Interchange	MPPC:	FUSION Power Plant Controller
AWG:	American Wire Gauge	MRFA:	Major Rectifier Fail Alarm
BATT:	Battery	NA:	Not available
BRG:	Battery Return Ground	NAS:	Network Access Server
CLI:	Command Line Interface	NC:	Normally closed
CMVR:	Common Mode Voltage Range	NO:	Normally open
CPU:	Central Processing Unit	NOC:	Network Operations Centre
CRT:	Critical	NTP:	Network Time Protocol
CSV:	Comma-Separated Values	OID:	Object Identifier
DAC:	Digital to Analog converter	PAD:	Packet Assembler Disassembler
DC:	Direct Current	PID:	Proportional Integral Differential
DCE:	Data Communication Equipment	PUE:	Power Usage Effectiveness
		PSTN:	Public Switched Telephone Number
DIP:	Dual In-Line Package	RAM:	Random Access Memory
DNS:	Domain Name System	REN:	Ringer Equivalence Number
DTR/DSR:	Data Terminal Ready/Data Set Ready	RFA:	Rectifier Fail Alarm
DTE:	Data Terminal Equipment	RLVD:	Request Low Voltage Disconnect
DST:	Daylight Saving Time	RMS:	Root-mean-square
EEPROM:	Electrically Erasable Programmable Read Only Memory	RFA:	Rectifier Fail Alarm
ESC:	Escape	RTC:	Real Time Clock
EMI:	Electromagnetic Interference	RTS/CTS:	Return to Send/Clear to Send
ESD:	Electrostatic Sensitive Device	RTU:	Remote Terminal Unit
FA:	Fuse Alarm	SDTA:	Step-Down Transformer Adapter
FCCP:	Float Charging Current Probe	SMTP:	Simple Mail Transfer Protocol
GND or GRD:	Ground	SMX:	Smart Expansion Module
HF:	High Float	SNMP:	Simple Network Management Protocol
HLV:	High Low Voltage	SPST:	Single Pole Single Throw
HMI:	Human Machine Interface	SSH:	Secure Shell
HTTP:	Hypertext Transfer Protocol	SSL:	Secure Sockets Layer
HTTPS:	Hypertext Transfer Protocol Secure	THD:	Total Harmonic Distortion
HVAC:	Heating, Ventilation and Air Conditioning	TSP:	Time set point
INFO:	Information	TCP:	Transmission Control Protocol
IP:	Internet Protocol	UCCP:	Unified Communication Client Platform
LAN:	Local Area Network	UCT:	Universal Coordinated Time
LCD:	Liquid Crystal Display	UPS:	Uninterruptible Power Supply
LED:	Light Emitting Diode	WLAN:	Wireless local Area Network
LF:	Low Float	VRLA:	Valve Regulated Lead Acid battery
LRE:	Logic Return Equalizer	XMODEM:	Simple File Transfer Protocol
LVD:	Low Voltage Disconnect	AI:	Analog Input

LVDP:	Low Voltage Disconnect Panel	BI	Binary Input
LVR:	Low Voltage Reconnect	BO	Binary Output

15 APPENDIX A – IP ADDRESS AND SUBNET MASK

An IP address is a 32-bit value divided into four (4) octets of eight bits each. The standard representation is four (4) decimal numbers (in the range of 0.255), divided by dots (e.g., 192.2.1.123). When shipped, the default IP address for FUSION is configured as 192.168.1.1.

The IP address is divided in two (2) parts: a network and a host part. To support different needs three (3) “network classes” have been defined. Depending on the network class the last one, two (2) or three (3) bytes define the host; while the remaining part defines the network. In the following text, ‘N’ stands for the host part of the IP address.

15.1 CLASS A NETWORK (IP ADDRESS 1.N.N.N TO 127.N.N.N)

Only 127 different networks of this class exist. These have a very large number of potential connected devices (up to 16777216). E.g. 10.0.0.1, (network 10, host 0.0.1).

15.2 CLASS B NETWORK (IP ADDRESS 128.0.N.N TO 191.255.NNN.NNN)

These networks are used for large company networks. Every network can consist of up to 65534 devices. E.g. 172.1.3.2 (network 172.1.3, host .2).

15.3 CLASS C NETWORK (IP ADDRESS 192.0.0.XXX TO 223.255.255.XXX)

These network addresses are most common. Smaller company networks are class C networks. These networks can consist of a maximum number of 254 hosts. E.g. 192.7.1.9 (network 192.7.1, host 9).

The remaining addresses (224.N.N.N - 239.N.N.N) are defined as “Class D” and are used as multicast addresses.



No addresses are allowed with the four (4) highest-order bits set to 1-1-1-1. (240.x.x.x - 254.x.x.x). These addresses, called “class E”, are reserved.

15.4 NETWORK ADDRESS

The host address with all host bits set to “0” is used to address the network as a whole (e.g. in routing entries).

15.5 BROADCAST ADDRESS

The address with the host part bits all set to “1” is the broadcast address, meaning “for every station”. Network and broadcast addresses must not be used as a host address (e.g. 192.168.0.0 identifies the entire network, 192.168.0.255 identifies the broadcast address).

15.6 IP NETMASK

The Netmask is used to divide the IP address differently from the standard defined by the classes A, B, C. By entering a Netmask it is possible to define how many bits from the IP address are to be taken as the network part and how many bits are to be taken as the host part.

The number of host bits is entered and FUSION then calculates the Netmask. The Netmask is displayed in a standard decimal-dot notation.

15.7 PRIVATE IP NETWORKS AND THE INTERNET

If the network is not connected to the Internet and there are no plans to make such a connection any IP address can be used.

However the network is not connected to the Internet and there are plans to connect to the Internet or the network is connected to the Internet and FUSION will be operated on an Intranet one of the sub networks below should be used. These network numbers have been reserved for such networks. If there are any questions about IP assignments please refer them to the Network Administrator.

Class A 10.x.x.x

Class B 172.16.x.x

Class C 192.168.0.x

15.8 NETWORK REQUEST FOR COMMENTS (RFC)

For more information regarding IP addressing please refer to the following documents. These can be located World Wide HTTP(S).

RFC 950 Internet Standard Subnetting Procedure

RFC 1700 Assigned Numbers

RFC 1117 Internet Numbers

16 APPENDIX B - SNMP INFORMATION

FUSION SNMP TRAP DESCRIPTIONS IN TERM OF OIDS

The following tables describe the six different Traps types sent by the FUSION. Table 107 and Table 109 provide the different Trap type descriptions while Table 108 and Table 110 describe the variable descriptions sent with the Traps.

Additional tables describe the OIDs linked to the FUSION best known Mnemonics.

This data is included in the Traps in order to identify the source of the alarms.

E.g., the alarm identifier in a Trap variable with the OID .1.3.6.1.4.1.5946.3.2.3.10.1.1.33020000 is 33020000 and represents F1E1.

Table 107- FUSION Trap descriptions (1)

OID	Trap names	Description	Trap content
.1.3.6.1.4.1.5946.3.2.0.2	domeAlarmClear	Trap Erased alarm	See Table 108
.1.3.6.1.4.1.5946.3.2.0.3	domeAlarmAssertLevel1	Trap Critical alarm	See Table 108
.1.3.6.1.4.1.5946.3.2.0.4	domeAlarmAssertLevel2	Trap Major alarm	See Table 108
.1.3.6.1.4.1.5946.3.2.0.5	domeAlarmAssertLevel3	Trap Minor alarm	See Table 108
.1.3.6.1.4.1.5946.3.2.0.6	domeAlarmAssertLevel4	Trap Informational alarm	See Table 108

Table 108 - Sent variables with each Trap described in Table 107

OID	Variable names	Description	Value example
.1.3.6.1.2.1.1.1.0	sysDescr	Software Product and Version	FUSION V4.21
.1.3.6.1.2.1.1.6.0	sysLocation	Site Name	FUSION Test
.1.3.6.1.4.1.5946.3.2.3.10.1.1.33020000	domeAlarmPriority	Trap Alarm Level	4
.1.3.6.1.4.1.5946.3.2.3.10.1.2.33020000	domeAlarmID	Alarm Identifier	33020000
.1.3.6.1.4.1.5946.3.2.3.10.1.3.33020000	domeAlarmMnemonic	Mnemonic of the Alarm Channel	F1E1
.1.3.6.1.4.1.5946.3.2.3.10.1.4.33020000	domeAlarmName	Name of the Alarm Channel	Door Open
.1.3.6.1.4.1.5946.3.2.3.10.1.5.33020000	domeAlarmOcc	Channel Occurrences Count	1
.1.3.6.1.4.1.5946.3.2.4.1.0	domeTrap.dome TrapString	Trap Message	Site intrusion Alarm
.1.3.6.1.4.1.5946.2.1.0	multitelSystemDateTime	Alarm Date and Time	0x07 0xDB 0x04 0x1C 0x0E 0x25 0x0E 0x00

Table 109 - FUSION Trap description (2)

OID	Trap names	Description	Trap content
.1.3.6.1.4.1.5946.3.2.0.11	domeHighestSeverityAlarm Change	Highest Level Change	See Table 110

Table 110 - Sent variables with each Trap described in Table 109

OID	Variable names	Description	Value example
.1.3.6.1.2.1.1.1.0	sysDescr	Software Product and Version	FUSION V4.50
.1.3.6.1.2.1.1.6.0	sysLocation	Site Name	FUSION Test
.1.3.6.1.4.1.5946.3.2.3.11.0	domeAlarmHighestPriority	Highest available Alarm Level	4
.1.3.6.1.4.1.5946.2.1.0	multitelSystemDateTime	Alarm Date and Time	0x07 0xDB 0x04 0x1C 0x0E 0x25 0x0E 0x00

Correlation between FUSION Mnemonics and SNMP IDs

Table 111 gives the connections between the most common FUSION Mnemonics and their SNMP IDs. When a less commonly used ID Mnemonic is needed it can be found using a MIB Browser by sending the Walk command to the domeBinaryMnemonic branch located in the table domeBinaryTable of the MIB DOME MULTITEL. When sending the Walk command to the FUSION it will return only the active mnemonics. Please note that to calculate the complete information from 3402....which is given in a table below in relation with TH...., the reference of 34020000 for TH1 can be taken by adding the number of the TH minus 1. e.g. The ID of TH68 is 34020000 plus 68 minus 1 equals 34020067. Use the same calculation for G beginning with 37020000 and F1E with 33020000.

Table 111 - Most common FUSION Mnemonics and their SNMP IDs

Mnemonic	ID	Mnemonic	ID	Mnemonic	ID	Mnemonic	ID
		LED1	42030000	F1E1	33020000	F1E17	33020016
F1O1	33030000	LED2	42030001	F1E2	33020001	F1E18	33020017
F1O2	33030001	LED3	42030002	F1E3	33020002	F1E19	33020018
F1O3	33030002	LED4	42030003	F1E4	33020003	F1E20	33020019
F1O4	33030003	LED5	42030004	F1E5	33020004	F1E21	33020020
F1O5	33030004	LED6	42030005	F1E6	33020005	F1E22	33020021
F1O6	33030005	LED7	42030006	F1E7	33020006	F1E23	33020022
		LED8	42030007	F1E8	33020007	F1E24	33020023
TH1	34020000	LED9	42030008	F1E9	33020008	F1E25	33020024
TH....	3402....	LED10	42030009	F1E10	33020009	F1E26	33020025
TH1500	34021499	LED11	42030010	F1E11	33020010	F1E27	33020026
		LED12	42030011	F1E12	33020011	F1E28	33020027
G1	37020000	LED13	42030012	F1E13	33020012	F1E29	33020028
G...	37020...	LED14	42030013	F1E14	33020013	F1E..	330200..
G200	37020199	LED15	42030014	F1E15	33020014	F1E64	33020063
		LED16	42030015	F1E16	33020015		

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2500 Jean-Perrin ST Suite 175
Quebec QC G2C 1X1
Tel: 418 847.2255
Toll Free: 1.888.685.8483
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