

iS³

Intelligent Small Site Supervisor

User's Guide



iS³
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Version 1.4
User's Guide

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About...

Certification Information

RESIDENTIAL EQUIPMENT

CLASS B DIGITAL DEVICE

INFORMATION TO USER

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures.

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Limited Warranty Policy on Multitel Hardware

MULTITEL represents, warrants and covenants to Buyer that, for a period of twenty-four months after shipping date of such Product, the Product when installed and used in accordance with specifications described in user manuals, technical materials and related writings published by MULTITEL with respect to such Product, shall be free from defects in materials and workmanship.

During the warranty period, MULTITEL or its designated service representative shall repair, or at its option, replace any Product that is confirmed to be defective by MULTITEL. Product repaired under warranty shall be warranted for six (6) months or for the non-expired portion of the warranty applying to the Product, whichever is longer. Buyer shall promptly notify MULTITEL of any Product's defect during the warranty period.

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General Information

Purpose

This document is intended to present the functions, applications and basic concepts of the iS³. An Installation manual is also provided with this product.

Application

The iS³ is a very versatile monitoring and control unit tailored for space-sensitive applications such as cabinets.

- Up to 28 real channels without expansion board and 44 with expansion board can be configured to detect harmful conditions, take measurements, and control local equipment;
- An almost unlimited number of derived channels can also be configured to process measurements or create complex alarm messages;
- Data logging files record information about your site, helping to trend and analyze site behavior;
- An easy-to-use Web browser-based interface that makes getting information a breeze.
- Support of SNMP with full HP OpenView integration kit.
- Pass-through function, offering an embedded 2 port terminal server.

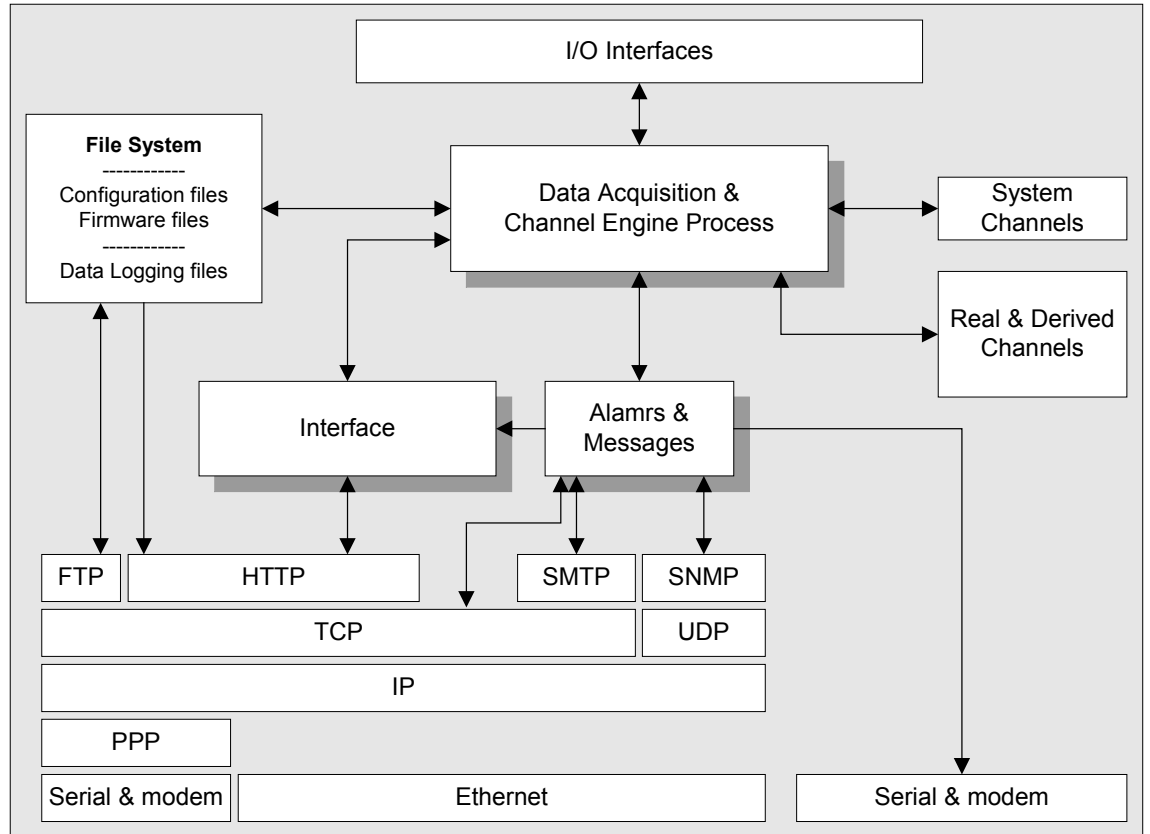


Figure 1 - iS³ functional overview

Since the iS³ is targeted for telecommunication applications, its internal power supply will accept the standard -48 VDC or +24 VDC, depending on the model.

CHAPTER 1

Introducing the iS³

The iS³ has all the traditional features of an RMU (remote monitoring unit), despite its small size and low power consumption. In fact, the iS³ possesses more features than most RMU, including extended connectivity provided by a standard Ethernet port and an optional internal high-speed modem.

Data acquisition is done using simple binary or more complex analog inputs. Using the latter type, measurement of voltage, current, temperature, humidity, and other parameters is done using a 12-bit analog to digital converter.

The iS³ offers an embedded Web server, providing a very easy means to view real-time data, download data logging files, calibrate the unit data acquisition channels, etc.

The iS³ also comes with an SNMP agent, SMTP support to send e-mails, an FTP server to easily upload and download configuration and data logging files. A pass-through function has been added in order to provide terminal server capability. This means you can connect legacy devices to your IP network through the iS³.

Users and their access to the iS³ can also be managed through the very unit. You can define a high number of users, each having one of 3 possible user access levels, allowing the management of users and the type of action they can perform while using the iS³.

Using the LAMBDA (Logical And Mathematical Built-in Data Analyzer) engine, the iS³ provides real time data processing. A set of derived channels, through which you configure unit behavior, allows you to build powerful custom applications that further process and analyze acquired data.

Getting Started

The first and most important step once the equipment has been installed, plugged and all proper connections have been made is to establish direct communication between your PC and the iS³. There are two main protocols to communicate with these units: the Ethernet and the PPP (point to point protocol).

Once the iS³ is installed, setting it ready to operate for the first time takes more than just turning the unit on. The unit is delivered with a default IP address which does not guarantee immediate communication between the unit and your PC because it is not necessarily compatible with your network. Therefore, to have these two units communicating through the same language, you will have to carry out, at least and depending on your operating system, one of the following two procedures.

PPP Connection Procedure (Windows '98)

To establish communication with the iS³ using Windows '98:

5. Connect a DB9 serial cable from the **RS-232 CRAFT DCE** port on the iS³ front panel to your PC.

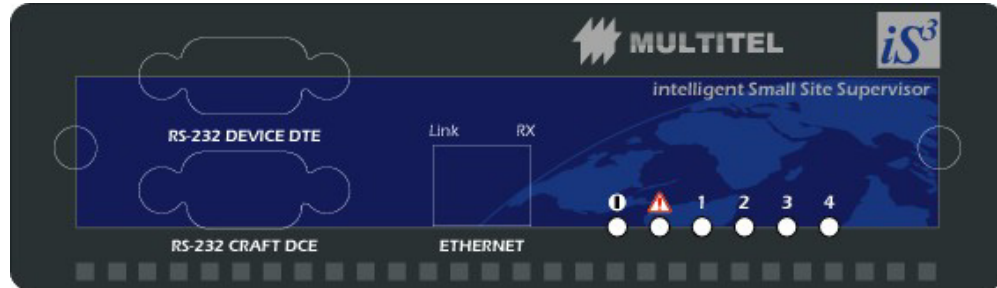


Figure 2 - Front Panel

6. Determine the iS³ baud rate, see Baud Rate Detection Procedure.
7. Add a standard modem.
 - a) Follow the sequence: **Start + Settings + Control Panel**.
 - b) Click on **Phone and Modem Options**.
 - c) In the Modems tab, verify there is no **Standard 33600 bps Modem** already installed. If you already have such modem installed, close this window and continue with step 8.
 - d) Click on **Add**.
 - e) Check the **Don't detect my modem; I will select it from a list** box.
 - f) Click on **Next**.
 - g) In the **Manufacturers** list, choose **Standard Modem Types**.
 - h) In the **Models** list, choose **Standard 33600 bps Modem**.
 - i) Click on **Next**.
 - j) Choose the port you want to use (**Com 1, Com 2...**) and click on **Next**.
 - k) Click on **Finish**.
 - l) In the **Control Panel**, double-click on **Phone and Modem Options**.
 - m) In the **Modems** tab, select **Standard 33600 bps Modem** and click on **Properties**.
 - n) In the **Maximum Port Speed** section, choose the baud rate that corresponds to the iS³ (you must have already determined it on step 6).
 - o) Click on **OK**, then on **Close**.
8. Create a PPP Connection.
 - a) In your desktop, click on **My Computer**.
 - b) Click on **Dial-up Networking + New Connection**.
 - c) Name your connection **iS³ Direct Connection**.

- d) Select **Standard 33600 bps Modem**.
 - e) Click on **Configure**.
 - f) Click on **OK + Next**.
 - g) Type in the telephone number “555” + **Next + Finish**.
 - h) Right click on your connection and select **Properties**.
 - i) Uncheck the **Use area code** box.
 - j) Select the **Network Management** tab.
 - k) Uncheck all the available boxes except **TCP/IP**.
 - l) Select the **Running Script** tab.
 - m) Click on **Run** and search for the script provided by Multitel (Multitel iS³ PPP.scp).
 - n) Click on **OK**.
9. You are now ready to launch the connection; click on **iS³ Direct Connection + Connect**.
 10. If the connection is not successful, revise the connection procedure and the cables.
 11. After the connection has been established, click on **Start + Run**.
 12. In the **Open** text field, type “winipcfg” and then click on **OK**.
 13. Take note of the IP address.
 14. Open you Internet browser and type the IP address that you jotted down minus ONE. As an example, if you found the following IP address: 192.68.10.11, the **iS³** IP address will be 192.68.10.10.
- At this point you should see the **iS³** web page.

PPP Connection Procedure (Windows 2000)

To establish communication with the **iS³** using Windows 2000:

1. Connect a DB9 serial cable from the **RS-232 CRAFT DCE** port on the **iS³** front panel to your PC.

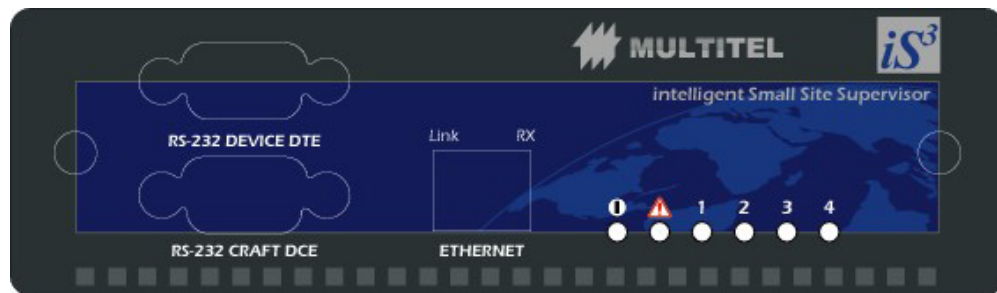


Figure 3 - Front Panel

2. Determine the **iS³** baud rate, see Baud Rate Detection Procedure.
3. Add a standard modem.
 - a) Follow the sequence: **Start + Settings + Control Panel**.
 - b) Click on **Phone and Modem Options**.

- c) In the **Modems** tab, verify there is no **Standard 33600 bps Modem** already installed. If you already have such modem installed, close this window and continue with step 8.
 - d) Click on **Add**.
 - e) Check the **Don't detect my modem; I will select it from a list** box and click on **Next**.
 - f) In the **Manufacturers** list, choose **Standard Modem Types**.
 - g) In the **Models** list, choose **Standard 33600 bps Modem** and click on **Next**.
 - h) Choose the port you want to use (**Com 1, Com 2...**) and click on **Next**.
 - i) Click on **Finish**.
 - j) In the **Control Panel**, double-click on **Phone and Modem Options**.
 - k) In the **Modems** tab, select **Standard 33600 bps Modem** and click on **Properties**.
 - l) In the **Maximum Port Speed** section, choose the baud rate that corresponds to the iS³ (you must have already determined it on step 0).
 - m) Click on **OK**, then on **Close**.
4. Create a PPP connection.
- a) Click on **Start + Settings** and double click on **Network and Dial-up Connections**.
 - b) Double click on **Make New Connection** and click on **Next**.
 - c) Choose **Dial-up to the Internet** and click on **Next**.
 - d) Choose **I want to set up my Internet connection manually, or I want to connect through a local area network (LAN)**, then click on **Next**.
 - e) Choose **I connect through a telephone line and a modem**, then click on **Next**.
 - f) If you have only one modem installed, do the next step; if not, choose the **Standard 33600 bps Modem** that you already created and click on **Next**.
 - g) Type the telephone number "555".
 - h) Uncheck the **Use area code and dialing rules** option, then click on **Next**.
 - i) Do not enter any password, click on **Next**.
 - j) Click **Yes** on the warning.
 - k) Name your PPP connection **iS3 Direct Connection**, then click on **Next**.
 - l) Answer **No** to the question: **Do you want to set up an Internet mail account now?** Then, click on **Next**.
 - m) Do not check the **To connect to the Internet immediately, select this box and click Finish** box. Click on **Finish**.
 - n) In the **Network and Dial-up Connections**, right-click on **iS³ Direct Connection** and select **Properties**.

- o) Select the **Security** tab.
 - p) Select **Run script**.
 - q) Click on **Browse** and search for the script provided by Multitel (Multitel iS3 PPP.scp).
 - r) Select the **Networking** tab and click on **Settings**.
 - s) Uncheck the **Software Compression** option and click on **OK**.
 - t) Select **Internet Protocol (TCP/IP)**
 - u) Click on **Properties + Advanced**.
 - v) Uncheck the **Use default gateway on remote network** and click **OK** in the following three dialog boxes.
 - w) Click on **Start + Settings + Control Panel + Internet Options**.
 - x) Select the **Connections** tab.
 - y) In the **Dial-up and Virtual Private Network** settings set up the default connection, which you must have previously jotted down, and select the **Never dial a connection, dial whenever** option. Click on **OK** to exit.
5. Now you are ready to establish the connection, to do that: click on **Start + Settings + Network and Dial-up Connections + iS3 Direct Connection** and then on **Dial**.
 6. If the connection is not successful, check the connection procedure and the cables.
 7. After the connection has been established, double-click on it, select the **Details** tab to find the server IP address.
 8. Launch your Internet browser and type the server IP address, press **Enter**. You must access the iS³ web page.

Baud Rate Detection Procedure

The iS³ baud rate is generally 115200 bps. If you have access to the iS³ configuration files, use the iS³ Configuration Tool software to find out the iS³ RS-232 CRAFT DCE port baud rate. The following procedure is useful in the case you don't have access to the configuration files and you need the baud rate to establish the connection.

1. Make sure there are no open applications in your PC.
2. Launch the HyperTerminal application.
 - a) Click on **Start + Run**.
 - b) In the **Open** text field, type "Hypertrm.exe" and click on **OK**.
3. Name your connection, ex.: iS³.
4. In the **Connect using** tab, choose the PC serial port you want to use to communicate with the iS³ (usually **Com 1** or **Com 2**) and click on **OK**.
5. In the **Port Parameters** window, change the bits per second to 115200 and click on **OK**.
6. Click on the main window to select it.
7. On your keyboard, press **Enter** four times. If you see the equipment identification on the display, it means you have found the good baud rate. Then, the procedure is finished.
8. If not, click on the **Call** menu, then select **Disconnect**.

9. Click on the **File** menu, then **Properties**.
10. In the **Connect** using list of the **Connect to** tab, select the right port and click on **Configure**.
11. Change the **Bits per second** to the immediate lower available value and click on **OK**.
12. In the **Port Parameters** window, click on **OK**.
13. Click on the main window to select it.
14. On your keyboard, press **Enter** four times. If you see the equipment identification on the display, it means you have found the good baud rate.
15. Take note of the baud rate and close the window.

NOTE:

You should continue to try this procedure with the immediate lower value until you find the correct baud rate.

Changing the PPP Connection Baud Rate (Windows 2000)

To change the PPP connection baud rate for Windows 2000:

1. Click **Start + Settings + Network and Dial-up Connections**.
2. In the **Network and Dial-up Connections** window, right-click on your connection and select **Properties**.
3. In the **General** tab, click on **Configure**.
4. In the **Maximum speed (bps)** list, choose the desired baud rate and click on **OK**.
5. In the **Properties** windows, click on **OK**.
6. Click on **Start + Settings + Control Panel**.
7. In the **Control Panel** window, double-click on **Phone and Modem Options**.
8. Click on the **Modems** tab.
9. Double-click on the **Modem standard 33600 bps**.
10. Change the maximum speed to match the one previously set in the **Network and Dial-up Connections** window and click on **OK**.
11. In the **Phone and Modem Options** window, click on **OK**.

Your connection is now ready to be used with the new baud rate.

Changing the PPP Connection Baud Rate (Windows '98)

To change the PPP connection baud rate for Windows '98:

1. On your desktop, click on **My Computer**.
2. Double-click on **Dial-up Networking**.
3. Right-click on your connection and select **Properties**.
4. In the **General** tab, click on **Configure**.
5. In the **Maximum speed** section, select the desired baud rate from the list and click on **OK**.
6. In the **Properties** window, click on **OK**.

Your connection is now ready to be used with the new baud rate.

CHAPTER 2

Channels

Channels are a central concept to the iS³. Channels are used to retrieve information, filter it, and raise alarms when any abnormal condition occurs.

For example, when connected to sensors, detectors or other measurement equipment, channels can be used to monitor temperature in a telecommunications site, to detect smoke, or to calculate the power dissipated by the load.

Different Types of Channels

Channels in the iS³ can be real or derived, analog or binary.

Channels are mainly differentiated by the type of information they produce (the output of the channel). This means that a channel called a “binary channel” outputs a binary value, whereas an “analog channel” outputs an analog value.

Moreover, channels are also differentiated by the source of the information they use. Real channels are physically connected to equipment in the telecommunications site, while derived channels use information from other channels; therefore, they are not directly connected to a physical source in the site.

Channels MUST be

1. Analog OR Binary,
- AND
2. Real OR Derived

	REAL	DERIVED
ANALOG	Real analog channel	Derived analog channel
BINARY	Real binary channel	Derived binary channel

Figure 4 - Channel matrix

Real Channels

Real channels are the most commonly known type of channels in remote monitoring and site management equipment. A real channel in the iS³ is connected to a physical source, such as a detector activating a simple contact closure or an accessory connected to a voltage source to be measured.

A real channel is associated with a connector at the back of the iS³, where the meter, detector or equipment is plugged in.

For example, a real channel can be connected to batteries to monitor their voltage, to a motion detector to know when someone is in your site, or to a local generator set to remotely or automatically control it in case of an AC power failure.

WARNING:

Unused pins in the J1 connector must be left unconnected since they are not protected against high voltage, e.g. -48VDC and permanent damage to the iS³ may occur.

WARNING:

The binary output loads must preferably be resistive and must not exceed 0.5A @60VDC. Inductive loads must use protection diodes to prevent inductive voltage spikes when loads are de-energized.

Real channels may return one of two types of information: binary information or analog information. That is, binary channels return only binary information, while analog channels return only analog information.

Derived Channels

Derived channels are also known as computed channels. A derived channel is not connected to a physical source in your telecommunications site. It generally uses data from other channels in the iS³, real or derived, to create a series of combinations of information to actually suit your needs.

Derived channels are used to process information from any other channel in your device. For example, a derived channel can be used to detect when battery voltage exceeds acceptable limits, to compute the power consumed by the load, or to calculate the difference between battery and ambient temperature.

Depending on the type of channel analog or binary, derived channels may return two types of information: binary information or analog information. That is, binary channels return only binary information, while analog channels return only analog information.

Analog Channels

Analog channels can be real or derived. These channels provide an analog value. Any analog channel may be used as the input for any other channel whose input is an analog value.

Real analog channels are often connected to some kind of transducer (e.g. temperature probe) that produces an analog signal. These channels read, digitize and

return the value of the input signal. For example, an analog channel connected to a temperature probe will produce a value that corresponds to the temperature reading picked up by the probe.

Derived analog channels will be used to make calculations from any analog channel value. For example, by adding the amperage from 3 real analog channels connected to different loads in the telecommunications site, the derived analog channel calculates the total current drawn.

There are several types of analog channels. To know more about real and derived analog channels, read the Detailed Channel Description section.

Binary Channels

Binary channels can be real or derived. They are used to detect conditions, raise warnings, or automate repetitive tasks. Any binary channel may be used as the input for any other channel whose input is a binary value.

Real binary channels have two main states: ON or OFF. They are either connected to a detector, such as a smoke detector, or to local equipment, such as a rectifier or LED on the iS³ front panel.

When connected to a smoke detector, the binary input channel will turn on when smoke is detected; when connected to a heat exchanger, the binary output channel may turn on or off the heat exchanger.

Derived binary channels can be used in the automatic activation or deactivation of warnings or equipment. They are usually utilized by other binary or analog channels, and return a value – ON or OFF – that is used by other channels in the system.

For example, a derived binary channel can be used as a threshold to activate a high voltage alarm. The binary channel monitors the battery voltage channel, and turns ON when a certain level of voltage is reached. Derived binary channels can also be used to delay the activation of a warning, to avoid false alarms.

There are several types of binary channels. To know more about real and derived binary channels, read the Detailed Channel Description section.

Channel Returned Values

Depending on their type, channels return different values. In short, as stated before, analog channels return analog values and binary channels return simple ON/OFF binary values. Channels can also return other values in some specific cases. For example, if a channel appears in a system configuration but is configured as disabled, it will return the special DIS value (disabled).

CHANNEL TYPE	RETURNED VALUE	COMMENT
Binary	ON	Channel value is "Boolean" TRUE
	OFF	Channel value is "Boolean" FALSE
	DIS	Channel is disabled. Causes may be: <ul style="list-style-type: none"> - Channel configured as disabled (in iS³ Configuration Tool) - Too many sources of this channel returned DIS
	N/A	Channel can't return a value. Causes may be: <ul style="list-style-type: none"> - Failure of channel (for real channels) - At boot time (Initialization value)
<i>Note: For binary output channels, DIS and N/A will be interpreted as an OFF condition</i>		
NORMAL CONDITION		
Analog	OVL+	Channel overflow (exceeds maximum value permitted)
	OVL-	Channel underflow (under minimum value permitted)
	DIS	Channel is disabled. Causes may be: <ul style="list-style-type: none"> - Channel configured as disabled (in iS³ Configuration Tool) - Too many sources of this channel returned DIS
	N/A	Channel can't return a value. Causes may be: <ul style="list-style-type: none"> - Failure or channel (for real channels) - At boot time (very short period) - Invalid configuration
<i>Note: OVL+ and OVL- conditions are correctly interpreted by binary threshold channels. Refer to individual channel section for information on exceptions.</i>		

Table 1 - Returned values

Categories

The notion of category is tightly linked with the embedded Web interface that the iS³ system monitors offer you. Categories allow you to group channels, whatever their types (real or derived, analog or binary) under user-defined categories. Here is an example:

The screenshot shows the iS3 web interface in Microsoft Internet Explorer. The browser title is "iS3 - Microsoft Internet Explorer" and the address bar shows "http://209.89.97.237/main.htm". The page header includes the MULTITEL logo and "Alarms" status. Below the header, there are navigation options: "Active Alarms", "File Transfer", "Derived Channels", "System Information", and "Logoff". A "CATEGORIES" list on the left includes "DC Power", "Battery", "Rectifiers", "Environment", "AC Power", "Access", "Other Alarms", "Misc", "Manual Controls", and "System". The main content area is titled "Battery" and contains two tables.

Alarms Level Summary:

Level	1: 1	2: 0	3: 0	4: 0	5: 0	6: 0	7: 0
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Active Alarms Table 1:

Channel Name	Mnemonic	Value	Counter
Battery Delta Temp Threshold	BTH1	OFF	2
Very High Delta Temp Threshold	BTH3	OFF	1
Low Battery Volatge	BTH4	OFF	0
High Voltage	BTH5	OFF	1
High Delta Temp	BAM2	OFF	2

Active Alarms Table 2:

Channel Name	Mnemonic	Value	Units
Plant Volatge	U1M1A11	52.95	Vdc
Load Voltage	U1M1A12	51.68	Vdc
Battery String 1 M-P Voltage	U1M1A13	-0.65	Vdc
Battery String 2 M-P Voltage	U1M1A14	0.43	Vdc
Battery String 1 Temperature	U1M1A15	29.40	C
Battery String 2 Temperature	U1M1A16	27.11	C
Ambient Temperature	U1M1A17	21.44	C
Battery String 1 Current	U1M1A19	-1.80	Adc
Battery String 2 Current	U1M1A110	-1.01	Adc

Figure 5 - Web page

In the figure above, which is a typical page of the iS³ Web interface, the lower left frame presents the user-defined categories. These categories were configured from the iS³ Configuration Tool software.

All category names are configurable, except for the “System” category. You can associate any channel to any category. Also note that a channel may belong to more than one category. Hence, a channel returning battery temperature may be in the environment category as well as the battery category, allowing a quick comparison between battery temperature and ambient temperature channels.

Alarms and Alarm Priority

The notion of alarm may have several meanings. A device alarm may be

- An alarm sent to a hardware alarm-gathering unit,
- An SNMP trap sent to some SNMP managers that present those traps as alarms,
- Proprietary messages sent to a NEM (Network Element Management) system,
- Etc.

In the iS³ Configuration Tool, an alarm priority may be associated to every binary channel.

NOTE:

The specific notion of alarm is internal to the iS³ system monitoring device.

This is not linked in any way with other “higher level” alarm concepts. The alarms you define in the iS³ Configuration Tool only appear in the user interface provided by the iS³ system monitors. To report alarms to a central surveillance system, then you may use SNMP, SMTP, simple ASCII text or even simple binary outputs.

CHAPTER 3

Detailed Channel Description

The following chapter describes how the iS³ works. This will help you understand the basic mechanism as well as make the relationships between the different functional features.

Channels

As described in the previous chapter, channels are the basic source of information for the iS³. They are used to collect, filter and process information to the surveillance technicians.

Channel Configuration

Before being used, all channels must be configured. The Windows-based iS³ Configuration Tool software is used to easily enter necessary parameters to configure each type of channel. Even if the iS³ Configuration Tool is user-friendly and easy to use, it is mandatory to understand the concept of each type of channel. The following sections will describe the type of channels supported, their use and finally provide details relative to the channel characteristics.

It is also important to mention that each channel type is fully described by its parameters and associated values.

Binary Channel Characteristics

Binary Channel Returned Values

A binary channel may return an ON or an OFF value. However, binary channels may also return DIS and NA values.

DIS, for disabled, means either that the actual channel is configured as disabled and thus, not in use, or that its sources are disabled. NA, which means not available, is returned when a problem is encountered with the channel. For example, if a real binary channel is defined as non-operational during the boot process, this specific channel would then return an NA value. Since binary channel returned values often appear as an input in a derived channel (for example, a binary equation), a truth table needs to be defined in order to set known rules. Refer to Appendix A for a complete truth table.

Common Binary Channel Parameters

All binary channels have a similar set of properties that have to be configured before being used. It is important to understand that each binary channel is individually configurable.

This means that each individual binary channel has the following parameters:

Enabled :	When disabled, the channel always returns a DIS value, which is interpreted differently than ON or OFF. Refer to Appendix A for a complete truth table.
Data Logging:	Defines if each transition of the binary channel shall or shall not be time-stamped and recorded into the data logging file (history).
Alarm Priority:	This is the alarm priority associated with the channel. When the channel goes from OFF to ON, an alarm condition is set. The alarm priority goes from 1 to 7, 1 being the most important. A value of 8 means no alarm.
Channel name:	A string of up to 40 characters may be used to identify this channel
Category:	Categories are a practical way of grouping channels. There are 15 possible user-defined categories. Note that a channel may belong to more than one category. Categories are mainly used for filtering and sorting in the user interface. There is a 16 th category, called System, which is always defined and not user-configurable.
Messaging	
Autonomous message:	When a binary channel turns ON, it may trigger the sending of a message (SNMP trap, e-mail, etc). This specifies which message to use.
Associated Channel:	This field identifies a channel reference (often an analog channel) that is the root cause for sending the message. For example, a binary threshold may trigger an autonomous message, but the root cause is the channel associated with the analog value that is compared in the binary threshold channel.

Binary Channel Occurrence Counter

Each binary channel has an occurrence counter associated to it. This counter is incremented by one each time the binary channel returned value goes from any not ON value to the ON value. The only exception is when the unit is powered up, when the transitions from NA to ON is not recorded. This means that OFF to ON transitions, DIS to ON transitions and NA to ON transitions all increment the occurrence counter of the associated binary channel. The value of the occurrence counter is accessible to the user through the use of the “Analog Binary Occurrence Counter” channel.

Binary Occurrence counters are reset to zero through user-configured conditions. The maximum value of the occurrence counters is 32000.

NOTE:

There is no automatic return to zero when the occurrence counters hit their maximum value.

Analog Channels Characteristics

Analog Channel Returned Values

Analog channels are used to measure many different types of values: voltage, temperature, current, etc. Analog channels return an analog value that sits within the range of the programmed scale (SC parameter as shown in next section).

If the value is out of range, special values are returned: OVL+ or OVL-, which stands for overload and under load respectively. Like binary channels, analog channels might also return the special DIS and NA values.

VALUE	MEANING
Any number	The value is within the range of the programmed scale and the channel is enabled
DIS	The channel is disabled or its source(s) disabled.
NA	The channel is not properly operating (abnormal condition)
OVL+	The value is out of range (overload)
OVL-	The value is out of range (underload)

Table 2 - Returned values for analog channels

Common Analog Channel Parameters

Each analog channel is individually configurable. Like binary channels, there is a subset of configuration parameters that is common to all analog channels.

Enabled:	When disabled, the channel always returns a DIS value, which is interpreted differently than any other analog value.
Channel Name:	A string of up to 40 characters may be used to identify this channel
Engineering Units Scale:	This is a scaling factor that simply defines the full range of an analog channel. For example, a scale defined as 80 means a full range of -80 to +80.
Units:	A simple character string of 5 characters or less used to identify the units associated to the value returned by the analog channels. "Volts", "Amps", "VDC", "VAC", are all valid examples.
Decimal places:	This parameter defines the number of decimal places, or number of digits after the decimal period. Note that this is only used to display the internal values.

Category:	Categories are a practical way of grouping channels. There are 15 possible user-definable categories. Note that a channel may belong to more than one category. Categories are mainly used for filtering in the user interface. There is a 16 th category, called System, which is always defined and not user-configurable.
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Channel Description – by Type

Real Channels

Real channels are physically connected to measurement or detection accessories. They can also be connected to local equipment.

NOTE:

The physical “Front End” interface on the iS³ cannot be changed. You must hence connect your binary signals to the proper binary input channel type.

Binary Input Channels

There are 2 types of binary input channels. The only difference is the type of physical interface (electronic circuit) they possess.

Dry Contact Binary Input Channels

This type of channel can detect an open or closed circuit, basically provided by a simple switch. You may have the channel turn ON for the condition of your choice, whether it is when the switch opens or closes. You can also say that this channel detects the difference between a ground level and any other condition.

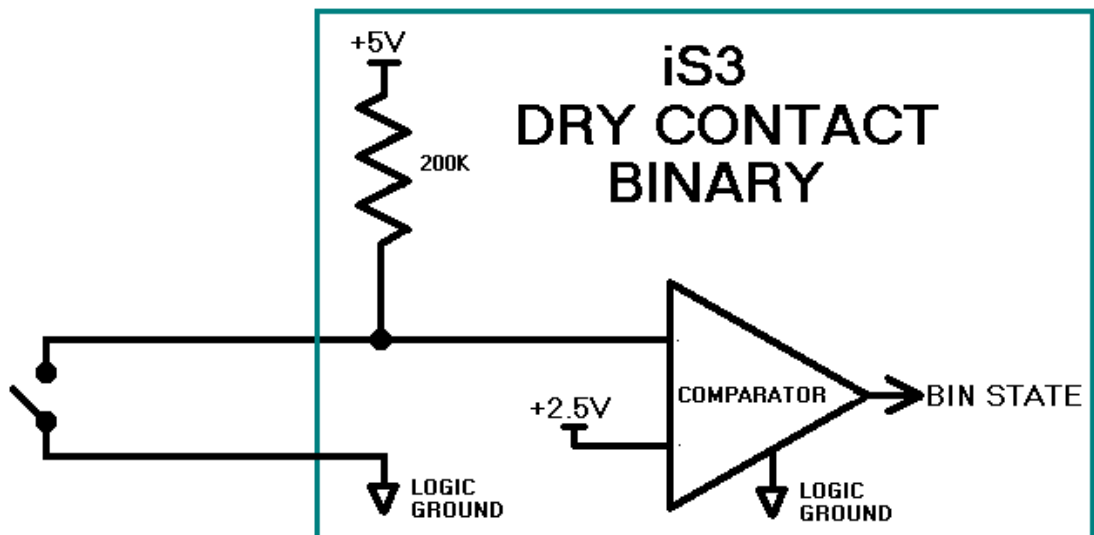


Figure 6 - Dry contact binary channel schematics

Level Binary Input Channels

This is very similar to the “Dry Contact” described before, with one more refinement. The input can make the difference among 3 “states” of voltage levels: near ground, floating input, and near battery voltage input. Since this is a binary channel, it should only return two values: ON or OFF.

With this type of channel, the added flexibility comes from the fact that you may decide, for each state or voltage level, if it is associated to ON or OFF. Most of the time, you decide if the floating level is to be associated to the ground level or to the “Hot” side, also known as the “battery” side.

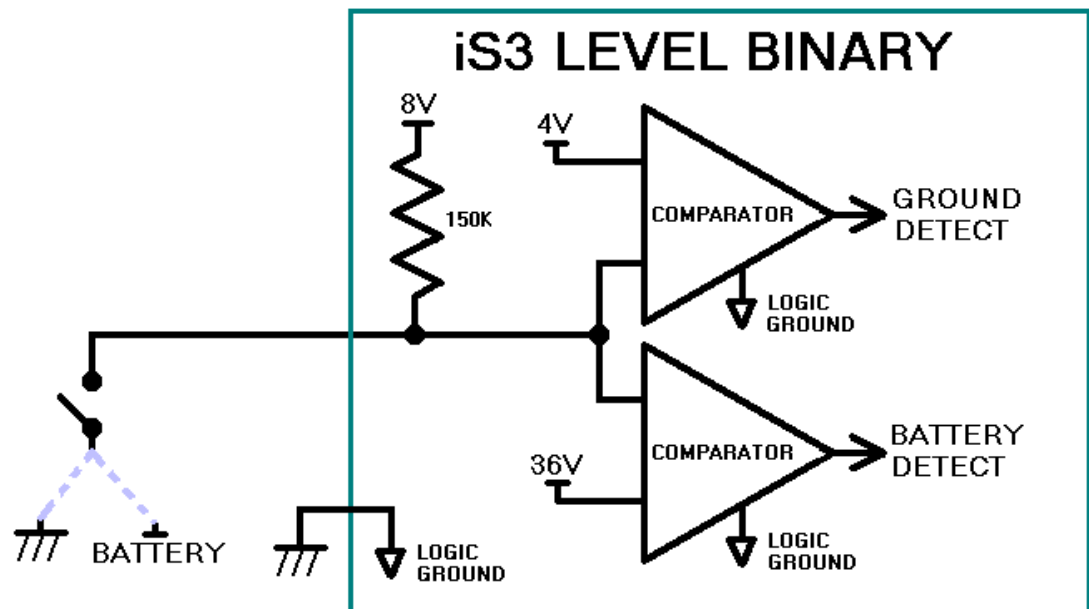


Figure 7 - Level binary channel schematics

Specific Binary Input Channel Parameters

The specific, individual configuration parameters are:

Hardware layout:	This is the type of physical interface that the channel supports. As explained, there are 2 options: “dry contact” and “level”.
Voltage level for “hot”:	For the level type of input, you need to specify the reference voltage for the measurement: $\pm 24\text{VDC}$ or $\pm 48\text{VDC}$.
Active on (level):	For the level type of input, you also need to specify on which level the channel will return an ON (true) condition. Choices are BRG (battery return ground), float and “hot”. You usually choose one or two levels for the ON condition.
Active on (dry contact):	For the dry contact type of input, you simply specify if the ON condition is detected on an opened or closed contact.

Using Binary Input Channels

- a) Detect the presence of smoke in your telecom site. Install a smoke detector in your site, then connect it to a binary input channel. When the equipment detects smoke in your site, a contact closure will be detected on the specified binary input channel. An alarm may then be configured to alert your surveillance team.
- b) Be warned of illicit entry in your telecommunications site. Use a door contact connected to a binary input channel on the iS³. When the door of your telecommunications site is open, the door contact will change state and be detected by the binary input channel, which can be used as a source of alarm to warn your surveillance team.
- c) Be aware of equipment failure. Connect your local equipment fail relay to binary input channels on the iS³. When the equipment fail relay is activated, the binary input channel will change state. This input channel can then activate an autonomous message to warn your maintenance team.

Binary Output Channels

Binary output channels are contact relays used to activate or deactivate equipment or simply to raise an alarm.

Binary output channels are activated automatically by another binary channel. When its source channel is ON, the binary output channel is ON.

Specific Binary Output Channels Parameters

The specific individual configuration parameters are:

Hardware layout: Here, you specify which type of hardware layout the binary output may have: choices are simply form-A relay or form-C relay.

Using Binary Output Channels

- a) Use a binary output channel to start a heat exchanger when a certain level of temperature is reached in your telecommunications site. When the source channel (a binary threshold) is ON, the binary output channel sends a signal to activate the heat exchanger.
- b) Use a binary output channel to turn on the lights when a technician enters your telecommunications site. When the source channel (a binary input channel connected to a motion detector or a door contact) is ON, the binary output channel activates your lighting system.
- c) Use a binary output channel to start your local generator when AC power fails. When the source channel (a binary input channel connected to an ACD-01 – AC Detector) is OFF, the binary output channel sends a signal to activate the generator in your telecommunications site.

Analog Input Channels

Analog input channels are connected to an accessory or a wire that takes measurements in your telecommunications site, such as a temperature probe.

Specific Analog Input Channels Parameters

The specific individual configuration parameters are:

Hardware layout: Here, you specify which type of hardware layout the analog input may have: 70VDC, ± 50 mVDC, temperature probe interface, humidity probe interface or mid-point voltage interface. These shall be described in detail in your installation manual.

NOTE:

The physical “Front End” interface on the iS³ cannot be changed. You must hence connect your analog signals to the proper analog input channel type.

Using Analog Input Channels

- a) Connect an analog input channel to your battery string. The measurement produced by the iS³ internal analog to digital converter can then be visualized remotely, recorded in a data-logging file for further analysis, or monitored to activate alarms if it exceeds acceptable limits.
- b) Connect two analog input channels to temperature probes, one for ambient temperature and one for battery case temperature. The measurements taken by the probes are then available for remote viewing, but they can also be used to calculate your temperature delta (or differential) and identify abnormal battery overheating or the early stages of thermal runaway.
- c) Connect an analog input channel to a shunt to measure current. Values are not only made available remotely, but they can also be used by other channels in the iS³.

Analog Output Channels

Analog output channels can output an electrical signal on different scales, depending of their physical output capability or characteristics.

Analog output channels can be used to control certain type of equipments that require such an input.

Using Analog Output Channels

- a) You may adjust your rectifier output voltage depending on the actual temperature. This is commonly done and known as temperature compensation output voltage.
- b) Using an analog output channel connected to certain type of fan control system, it is possible to vary the speed of the fan according to the actual output voltage outputted by the analog output channel.

NOTE:

The iS³ does not currently support any analog output channels.

Binary LED Channels

Binary LED channels are used to turn ON and OFF LEDs on the front panel of the iS³. The LEDs on the front panel of the unit are used to help on-site maintenance technicians identify important conditions rapidly.

The LEDs on the iS³ can have two active states: blinking red or steady red. Different sources may be defined to activate the different states.

Specific Binary LED Channels Parameters

The specific individual configuration parameters are:

Hardware layout: Here, you specify which type of hardware layout the binary LED channel possesses: red or multicolor. Note that the iS³ only has red hardware layout LED.

LED control source channels

Steady: To activate a steady LED (steady ON), a source channel must be identified. Here, any binary channel could be chosen as the source.

Blinking: To activate a blinking LED (blinking ON-OFF), a source channel must be identified. Here, any binary channel could be chosen as the source. Remember that if both sources are ON, the LED will blink.

Using Binary LED Channels

- a) Activate a LED on the front panel to warn of high and critical battery temperature. Use one binary LED channel activated by a temperature threshold (a binary threshold channel) to turn ON the LED, and another to make it blink. Hence, when the battery temperature is high, the LED on the front panel of the unit will be steady red, and when temperature reaches a critical level, the LED will blink.
- b) Activate a LED on the front panel to warn of AC failure. Define your source as a binary input channel connected to an ACD-01 – AC Detector). When the source channel is ON, the binary LED channel will turn on the front panel LED.
- c) Make a LED blink when your local generator is in operation. Define your source as a binary output channel connected to a generator in your telecommunications site. When the source channel is ON, the binary LED channel will make the front panel LED blink.

NOTE:

A LED channel may have 2 distinct activation sources, one for the steady LED and the other for the blinking LED. The latter condition (blinking) always overrides the first. That is, if both activation sources are ON, the LED will blink.

Derived Channels

Derived channels are used to let you further configure the iS³. This enables you to truly customize the iS³ to suit your needs and requirements. Derived channels are like real channels: they can be binary or analog.

Derived channels should be seen as the building blocks with which you can program from simple to very sophisticated configurations.

Binary Threshold Channels

Binary thresholds are used to detect when an analog channel value exceeds a programmed limit. Thresholds may be used to activate alarms, such as a high voltage alarm. Other thresholds may be used to automate certain tasks, such as operating heating equipment when a certain temperature is exceeded.

To avoid the binary threshold channel going ON and OFF uselessly (output oscillation), a hysteresis should be defined. To do so, a different level is set for the deactivation level of the channel.

For example, you might want the binary threshold channel to turn ON when its source channel value exceeds 12, and to turn OFF when its source channel value reaches 10. This avoids your binary threshold channel going ON and OFF several times in a short period.

The first example here shows the change of a value over time. The threshold, as specified in the figure, intends to detect an upper limit.

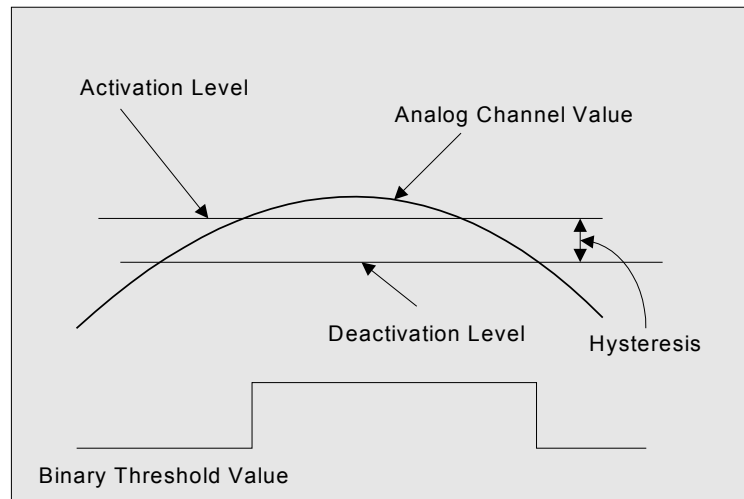


Figure 8 - Binary threshold activation schematics

When the value of the source analog channel goes over the activation level, the binary threshold returns an ON value. In order to return an OFF value once again, the value of the source analog channel has to fall below the deactivation level. Again, this insures that the binary threshold returned value will not rapidly change (oscillate) when the analog channel value is near the activation level.

The second example below shows the detection of a lower limit, that is, the activation level specified is lower than the deactivation level.

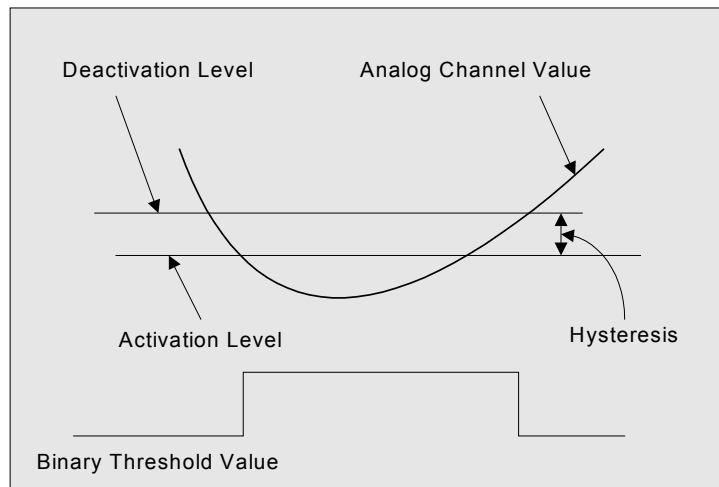


Figure 9 - Binary threshold deactivation schematics

Specific Binary Threshold Channels Parameters

The specific individual configuration parameters are:

Apply threshold to:	This parameter defines the analog channel to which the threshold applies.
Activation level:	The level at which the binary threshold will be activated.
Deactivation level:	The level at which the binary threshold will be deactivated.

Using Binary Threshold Channels

- a) Activate a high voltage alarm. Set your source channel as your analog battery voltage channel, then decide your activation and deactivation level. When your source channel (battery voltage) reaches the activation value, the binary threshold channel will turn ON. You can then use this channel as the activation source for your alarm.
- b) Start your heating equipment when temperature drops to a specified level. Set your source channel as your analog ambient temperature channel, then set your activation and deactivation levels. When your source channel (ambient temperature) exceeds the activation value, the binary threshold channel will turn ON. You can then use this binary threshold channel as the activation source for a binary output channel connected to the heating equipment in your telecommunications site.

- c) Create three levels of alarm for battery voltage. Create 3 binary threshold channels using the same source channel, each binary threshold having different activation and deactivation parameters. Then, when configuring the threshold channels, configure them with minor, major, and critical alarm levels. When your battery voltage level will begin rising, the severity of your alarms will change according to the actual battery voltage, enabling you to see the evolution of the condition.

Binary Delay Channels

Binary delay channels are used to program time set points (alarm clock), delays (wait) and debounce. These channels are used to program complex alarms, to set the duration of an event, or to program automatic recurring operations in your telecommunications sites.

Binary delay channels are activated by a binary source channel in the iS³ or at programmed intervals, for example every Monday at 8 A.M. Then, the channel will turn ON when the activation delay of the channel has expired.

The channel will turn OFF when the configured duration is elapsed or when the deactivation source of the channel turns ON.

Specific Binary Delay Channel Parameters

The specific individual configuration parameters are:

Mode:	A binary delay can be “complete” or “re-triggable”. Since binary delays have 2 distinct triggers (or sources), these 2 may or may not interact. In complete mode, the duration of the delay will always be as configured. In the case of a re-triggable delay, the delay may be restarted by the second activation source or second trigger, making the duration longer than the actual configured duration ¹ .
Activation time:	This is one of the 2 sources of activation of a binary delay. The delay could be triggered at a certain date/time, or recursively, at a day or days of the week at a certain time.
Activation source:	This is another binary channel used as an activation source. As described above, this is the second option to activate a delay. Both these sources (activation time and activation source) may be used together.
Activation delay:	The activation delay is used to further postpone the actual binary delay channel after one of the activation sources (time or channel) has come true.
Active duration:	This is the duration of the delay. Note that a 0 (zero) or an empty field means infinite duration.

¹ Please note that the actual duration might also be dependent of the deactivation source, which may turn off the binary channel before the end of the configured duration. For simplicity reasons, we did not take into account this fact in the example above.

Deactivation source:	This is a source channel that may be used to deactivate a binary delay channel.
Deactivation delay:	As for the activation delay, the deactivation delay is used to further postpone the action of the deactivation source (debouncing).

Using Binary Delay Channels

- a) Activate an alarm when there are reasons to believe the technician in the telecommunications site is unconscious. Set your source channel as the binary input channel connected to a magnetic door contact in the telecommunications site. Then set an activation delay for the binary delays channel of 30 minutes. Then set the binary delay channel as a source channel for an unconscious person alarm. When the site's door has remained opened for 30 minutes, an alarm will be sent to the surveillance center.
- b) Automatically send a simple message to your OSS everyday at midnight in order to indicate that the equipment is still under normal working condition (Keep alive message). Using a binary delay as a time set point, the output of the binary delay will activate an autonomous message everyday.
- c) Validate a dry contact binary input channel for 10 seconds in order to validate an alarm and avoid sending false alarms. Just use the binary input channel as the activation source of a binary delay channel and set a 10-second activation time. You could then use an infinite duration and set the deactivation source as the binary input channel turning OFF.

Binary Equation Channels

Binary equation channels permit imposing several conditions to activate an alarm or an automatic task. For example, you could activate an alarm when both a high temperature and a fan failure conditions are present on the telecommunications site. Binary equations use Boolean logic operators. Each equation can contain up to 20 binary channels as input, linked with one or several of these four operators:

- AND (&) is used when BOTH conditions must be present to turn ON the binary equation channel.
- OR (|) is used when ONE or BOTH conditions can turn ON the binary equation channel.
- XOR (^) is used when ONLY ONE of two conditions must be ON to turn ON the binary equation channel.
- NOT (!) is used when the condition must be OFF to turn ON the binary equation channel.
- Grouping () to change evaluation order.

Please refer to Appendix A for the Boolean truth table to better understand how these operators work, especially with disabled channels or problematic channels returning N/A value.

Specific Binary Equation Channel Parameters

The specific, individual configuration parameters are:

Equation: The binary equation itself is the only parameter. Using the iS³ Configuration Tool, you will have a user-friendly interface to build the equation.

Using Binary Equation Channels

- a) Activate an alarm when both a high temperature and a fan failure conditions are present. Build your equation linking the binary input channel connected to the fail relay on your fan and the binary threshold channel connected to your temperature channel with the AND (&) operator. Use this binary equation channel as the source to activate an alarm. When the temperature is high and the fan is in fail mode, the binary equation will turn ON, activating the alarm.
- b) Activate an alarm when you have reasons to believe there is an illicit entry to the telecommunications site. Build your equation linking your door open binary input channel and your keypad activation binary input channel with the AND (&) operator and the NOT (!) operator. Use this binary equation as the source channel to activate an alarm message. When the door is opened but the keypad is not activated, the binary equation will turn ON, activating the alarm message.
- c) Detect thermal runaway conditions. Build your equation linking your high battery temperature binary threshold channel, your high battery voltage binary threshold channel and your high float current binary threshold channel with an AND (&) operator. Use this binary equation as the source channel to activate an alarm message. When all three conditions are present, the binary equation channel will turn ON, activating the alarm message.

Binary Manual Channels

Binary manual channels allow to remotely activate and deactivate equipment. They can also be used to remotely test equipment. Binary manual channels can be turned ON or OFF in real time, using the user interface. They will remain in that state until they are manually reset or until the unit reboots.

For optimum security and operation, it is important to specify the access level necessary to activate and deactivate binary manual channels.

Specific Binary Manual Channel Parameters

The specific individual configuration parameters are:

Minimum user access level: This is the minimum user access level required in order to be able to change the status of the binary manual channel through the iS³ interface.

Default value at power up: This is the default status for this channel when the unit is powered up. It can be ON or OFF.

Using Binary Manual Channels

- a) Test a local generator or other equipment in the telecommunications site. Set a binary manual channel as the source channel for the binary output channel connected to the generator. When a user turns ON the binary manual channel, the binary output channel will turn ON, starting the generator.
- b) Manually disconnect a rectifier. Set a binary manual channel as the source channel for the binary output channel connected to the rectifier disconnect relay. When a user turns ON the binary manual channel, the binary output channel will turn ON, disconnecting the rectifier.
- c) Manually reset faulty or non-responding equipment. Set a binary manual channel as the source channel for the binary output channel connected to the equipment reset relay. When a user turns ON the binary manual channel, the binary output channel will turn ON, resetting the equipment.

Analog Hold Channels

Analog hold channels record a value from an analog channel, with or without basic processing, when the source binary channel turns ON.

Analog hold channels return the raw value of the source analog channel it applies to when the binary source channel is OFF. That is, when the binary source channel is OFF, the analog hold simply returns the value of its analog source channel. When the binary source channel turns ON, depending on the chosen function, the analog hold could then return:

- The value of the analog source at the moment the binary source turned ON;
- The absolute value;
- The highest, lowest, average or time integral value since the binary trigger channel has turned ON.

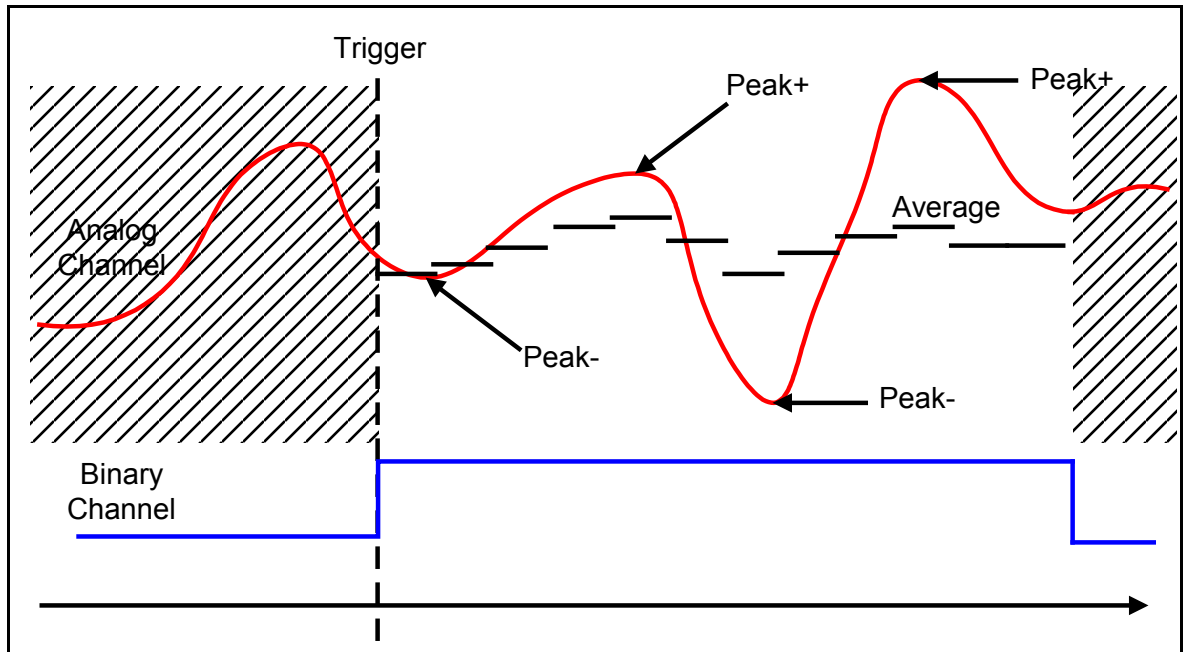


Figure 10 - Analog hold channel schematics

Specific Analog Hold Channels Parameters

The specific individual configuration parameters are:

Analog source channel:	This is the analog channel to which the analog hold function will apply.
Binary source channel:	This is the binary channel used as the trigger.
Function:	The function that will be performed on the analog source when the binary source is ON: hold, peak+, peak-, absolute value, average and time integral.

Using Analog Hold Channels

- a) Return the highest ambient temperature reached during a fan failure. Set your source channel as the binary input channel connected to the fan failure relay. Then set the analog hold channel to record the highest (PEAK+) value on the ambient temperature analog input channel. When the fan fails, its binary input channel turns ON, activating the analog hold channel, which will keep the ambient temperature to date until the fan fail binary input channel turns OFF.
- b) Return the current integral upon a battery discharge. Set your source channel as the battery on discharge binary equation channel. Then set the analog hold to compute the integral value on the battery current analog input channel. When a battery on discharge condition occurs, its binary equation channel will turn ON, activating the analog hold channel, which will start computing the battery current integral to date until the battery discharge condition disappears.

- c) Return battery voltage upon a battery disconnect condition. Set your source channel as the battery low voltage disconnect binary input channel. Then set the analog hold to return the actual value from the battery voltage analog input channel. When a battery low voltage condition occurs, its binary input channel will turn ON, activating the analog hold channel, which will record the value from the battery voltage analog input channel and keep it without further processing.

Analog “Binary Occurrence Counter” Channels

Analog “binary occurrence counter” (BOC) channels return the number of times a binary channel has changed state to ON. Every binary channel has a binary occurrence counter. The Analog BOC is necessary to use the value of an occurrence counter.

Analog BOCs can be useful to diagnose and document defective equipment, or to identify aging equipment that must be replaced.

Specific Analog BOC Parameters

The specific individual configuration parameters are:

Return occurrences of binary channel:	This is the associated binary channel whose changes of state will be counted.
Reset counter on binary channel:	This is an optional binary channel used as a trigger to reset the occurrence counter of the binary channel.

Using Analog BOC Channels

- a) Activate an alarm when equipment fails too often. Set a binary threshold channel for the analog occurrence counter connected to the equipment fail binary input channel. When the equipment has failed the number of times specified in the binary threshold channel, it will turn ON and activate an alarm.
- b) Record the number of battery high temperature conditions. Just read the occurrence counter associated to the battery temperature threshold and send an alarm if the number of occurrences is too high, using another threshold channel.
- c) Identify how many times an HVAC device has been started, simply by using the analog occurrence counter channel linked to the binary output channel that controls the HVAC.

Analog Computation Channels

Each analog computation channel performs one single calculation on a list of analog channels. Analog computation channels calculate average, summation, minimum and maximum values on the specified analog channel list.

While analog hold channels perform operations on a single channel, analog computation channels operate on several channels. Moreover, analog computation channels only work with real-time value, while analog hold channels can hold a value in memory.

To increase capacity to a very large number of channels, analog computation channels can be daisy chained like any other channel.

Analog computation channels can be used to calculate total plant or load current, or to calculate the average ambient temperature from several sensors in the telecommunications site.

Specific Analog Computation Parameters

The specific individual configuration parameters are:

Analog channel list: Up to 20 analog channels to which a function will be applied.
 Function: The type of operation to perform on channels: average, summation, maximum or minimum.

Using Analog Computation Channels

- a) Calculate total string current from several battery strings. Simply list your battery current analog input channels as source channels for the analog computation channel, then specify a SUMMATION operation. The analog computation channel will compute total battery current in real time.
- b) Calculate maximum load current from several equipment sources. Simply list your load current analog input channels as source channels for the analog computation channel, then specify a MAXIMUM operation. The analog computation channel will compute maximum load current in real time.
- c) Calculate the average temperature of battery strings. Simply list your battery temperature analog input channels as source channels for the analog computation channel, then specify an AVERAGE operation. The analog computation channel will compute the average temperature in real time.

Analog Polynomial Channels

Analog polynomial channels permit customizing a complex mathematical equation from one or two analog channels. A basic polynomial is provided, where you can specify channels and enter coefficient values:

$$Ax^2 + By^2 + Cxy + Dx + Ey + F$$

Where x and y are the analog source channels, and **A, B, C, D, E** and **F** are the coefficients of the equation.

Not all terms of the equation have to be filled in. For example, if you wish to calculate your temperature differential between the battery case and the ambient temperature, you may use only 2 terms of the polynomial. The other terms will be set to zero and not be taken into account.

Specific Analog Computation Parameters

The specific individual configuration parameters are:

Analog source “x”: This is any analog channel.

Analog source “y”: This is any analog channel.

Coefficients

A:	The first coefficient of the equation $Ax^2 + By^2 + Cxy + Dx + Ey + F$
B:	The second coefficient of the equation $Ax^2 + By^2 + Cxy + Dx + Ey + F$
C:	The third coefficient of the equation $Ax^2 + By^2 + Cxy + Dx + Ey + F$
D:	The fourth coefficient of the equation $Ax^2 + By^2 + Cxy + Dx + Ey + F$
E:	The fifth coefficient of the equation $Ax^2 + By^2 + Cxy + Dx + Ey + F$
F:	The sixth coefficient of the equation $Ax^2 + By^2 + Cxy + Dx + Ey + F$

Using Analog Polynomial Channels

- a) Convert a temperature reading from Celsius to Fahrenheit. First enter your temperature analog input channel as x . Then, set **D** (1.8) as the conversion coefficient and **F** (32) as the offset (all other coefficients set to 0). The analog polynomial channel will then convert the temperature reading from Celsius to Fahrenheit.
- b) Calculate the temperature difference between ambient and the battery case. First enter your battery temperature analog input channel as x and your ambient temperature analog input channel as y . Then set coefficients **D** as 1 and **E** as -1 (all other coefficients to 0). This analog polynomial channel will subtract the battery temperature from the ambient temperature, providing your temperature differential.
- c) Calculate the total power using the simple voltage multiplied with current equation. First enter your plant voltage analog input channel as x and your plant current analog input channel as y . Then set coefficient **C** as 1 and all others to 0. This analog polynomial channel will calculate your plant's power.

Analog Manual Channels

Analog manual channels are very similar to binary manual channels. The difference is that instead of simply specifying an ON or OFF status, you may specify any analog value in the range configured in the analog manual channel.

For optimum security and operation, it is important to specify the access level necessary to activate and deactivate binary manual channels.

Using Analog Manual Channels

- a) Modify a threshold dynamically using an analog manual channel. In fact, you do not modify the threshold itself, but the value fed to the threshold. To do so, instead of using a temperature channel directly in a threshold, use an analog polynomial. This polynomial would include the temperature channel and the analog manual, thus providing an offset to the temperature that will be returned by the polynomial.
- b) Set a rectifier floating voltage simply using an analog manual to feed an analog output channel.

Analog Binary Count Channels

The analog binary count channels use values from a list of binary channels, set up in the configuration, to return an analog value as a function of the binary outcome. That is, the equipment will display the number of channels, from the list of selected channels, that are currently in ON position or those in OFF position. It can also display the total number of channels from the selected list that are currently in either ON or OFF position. As a whole, there can be an analog binary count channel to return a value for any of the three above mentioned configurations.

Using Analog Binary Count Channels

In a telecom site there are usually three or four power rectifiers working in parallel to avoid a complete service failure. That is, when a battery is discharged, a rectifier automatically switches the power connection to another source, provided the service remains continuous and unaffected. Set a minor alarm using an Analog Binary Count Channel when one of the rectifiers does not perform. That is, out of a list of binary channels linked to the rectifiers, set a minor alarm when one of them is in ON position (not performing). Set a major alarm when two or more of these channels are in ON position.

System Channels

Introduction to System Channels

The main purpose of system channels is to signal an abnormal condition of the monitoring unit or its peripherals. That is, the unit self-monitors and returns warning or errors using the system channels. There is a number of specific system channels that each report on a specific condition of the unit. For example, the “System Lithium Cell Fault or Low Voltage” channel will turn ON if the lithium back-up battery fails completely or provides a too low voltage.

The advantages of using channels to return the information are numerous. Using the iS³ Configuration Tool, you can then ask the system to register every system fault in the history file, or you may send a message triggered by a system fault. This means that you use all system channels exactly as the other channels of the system. Also, the configurable parameters of the system channels are programmed exactly like parameters of other channels.

System channels are only binary. Basically, they return, for each specific sub-system or component monitored, a status of normal or abnormal operation.

System Channels Specifics

Unless otherwise specified, system binary channels behave like other binary channels. These channels will return the following values:

- OFF when there is no failure detected
- ON when a failure is detected
- DIS (disabled) when the option is absent (example: modem)

These channels will never return an NA value except at power up.

It is important to note that system channels use the same common parameters as the other real or derived binary channels. The only exception is that system channels cannot be user-disabled and that the main system channel cannot be removed from the data logging file.

System Channels List

Following is the list of system channels. Note that all these channels are automatically created.

SYSTEM CHANNEL NAME	MEANING	COMMENT
System Fault	Global system fault.	Turns ON if any other system fault channel turns ON
System CPU Reset	CPU reset	CPU reboot or unit power-up
System Int. Modem/DEVICE DTE Port fault	Internal modem and/or RS-232 DEVICE DTE port failure	
System Ethernet Port	Ethernet port failure	

System Module	Module (main or add-on) failure	
System Real Time Clock	RTC failure or not initialized	
System Lithium Cell Fault Or Low	Low or bad Lithium battery	
System RS-232 CRAFT DCE Port fault	RS-232 CRAFT DCE port failure	
System Test Mode Active	Test mode is active	Not a failure
System Configuration File	Configuration file problem	Possible causes: <ul style="list-style-type: none"> - Invalid file CRC, - Size out of range, - Invalid content, - Configuration does not match hardware options
System Date	Date changed	Not a failure Turns ON and OFF rapidly. Tracks date changes.
System EEPROM	EEPROM chip faulty	Usually unable to write to EEPROM or checksum error.
System Upload File	Successful file upload(s)	Not a failure

Note:

EEPROM stands for “Electrically erasable programmable read-only memory”.

CRC stands for “Cyclic redundancy check”.

Using System Channels

System channels may be used like other real or derived channels in a configuration. For instance, one may trigger an SNMP trap using the “System Date” channel.

Users and User Channels

User Channels

When users log on to the iS³, special “users channels” are turned ON. These channels **cannot** be used as source channels in the configuration. On the other hand, all user logins (as well as logoffs) are automatically added to the binary data logging file.

User Definition

Users are defined using the iS³ Configuration Tool. You specify parameters for each user you define. The most important parameter here is the access level. There are 3 access levels that grant different rights to users. They are:

- Viewer
- User
- Supervisor

Table 3 - Access levels specifics

Action	Viewer	User (Normal)	Supervisor
View Web pages	✓	✓	✓
Download data logging files	✓	✓	✓
Download config. (application)	✓	✓	✓
Upload config. (application)			✓
Download config. (device)	✓	✓	✓
Upload config. (device)			✓
Download config. (access)			✓
Upload config. (access)			✓
Reset data logging files		✓	✓
Reset Occurrence Counters		✓	✓
Calibration (real channels)			✓
Test Mode			✓
Upload main code			✓

Maximum Number of Users

The maximum number of users that can be configured is twenty. On the other hand, the number of users that can be logged on at the same time is limited to 6. The total number of users and viewers that can simultaneously be logged on is set to 5. However, only one supervisor can be logged on at any time.

CHAPTER 4

Messaging

Messaging is used to notify the users of a condition they want to be aware of. Messaging is configurable to adapt to your needs and requirements.

Each iS³ port (Ethernet, serial and MODEM) may be used to send a message, using one of several available protocols (SNMP for traps, SMTP for e-mails, Telnet or simple ASCII).

Each message can be fully defined. It can include specific text and special tags that refer to system items, such as the value from an analog channel. Its schedule list also enables the user to specify where to send the message depending on date and time, for example to send a message to a different technician during the weekend.

Three major components are used to define an autonomous message.

- **Binary autonomous messages.**
- **Schedule**
- **Message templates**

Binary Autonomous Messages

A binary autonomous message (BAM) is the result and application of a derived binary channel that uses any binary channel input information and combines it with configured message schedules and templates to inform users about a given condition or event. That is, this message can be configured as to how, when and through which means a given information is passed on to the users.

Every binary channel may be linked to a binary autonomous message. This means that when the source binary channel is turned ON, it activates the autonomous message channel it is linked to. The system will then build a message and send it.

Please note that autonomous messages work like other binary channels. This channel **cannot** be used as a source channel in a configuration, but its value (in fact its transitions) may be recorded in the history file by enabling the data logging associated to the autonomous message you configure.

Schedules

Schedules contain the information concerning the destination, the protocol and the physical communication port to use, and the time frame at which the message is to be sent.

It is important to understand that when a binary channel activates a message, the system will also use the autonomous message to look at its schedules to know if the actual time is in the active time slot of one of its schedules (up to four schedules may be specified for each message). If so, then up to four messages will be sent.

Hence, using several schedules for one autonomous message makes messaging versatile and powerful. This enables you to send the message to different persons depending on shifts or days of the week. Schedules may overlap and are completely independent from one another.

For example, an autonomous message may have a schedule to send the message during business hours, another to send the message outside business hours, and yet another to send messages during the weekends.

WARNING:

When programming emergency numbers and/or making test calls to emergency numbers:

- **Remain on the line and briefly explain to the dispatcher the reason for the call.**
 - **Perform such activities during the off-peak hours, such as early morning or late evenings.**
-

Message Templates

Message templates define the content of the message, the information that is sent. A message template is made of standard text and **tags**.

Tags are references to another object in the system. For example, when sending a message activated by a high ambient temperature condition, you may add a tag in the message template that inserts the value of the ambient temperature analog input channel.

An extended number of tags may be used:

Source channel value (at condition)	This tag will indicate the value of the binary channel that activated the autonomous message, at the time the condition occurred.
Source channel value (current)	This tag will indicate the value of the binary channel that activated the autonomous message, at the time the message was sent.
Source channel name	This tag will indicate the name of the binary channel that activated the autonomous message.
Source channel units	This tag will indicate the units of the channel that activated the autonomous message, if that channel is analog.
Source channel occurrence counter	This tag will indicate the occurrence counter value of the channel that activated the autonomous message.
Associated channel value (at condition)	This tag will indicate the value of the channel associated with the autonomous message, at the time the condition occurred.
Associated channel value (current)	This tag will indicate the value of the channel associated with the autonomous message, at the time the message was sent.
Associated channel name	This tag will indicate the name of the channel associated with the autonomous message.
Associated channel units	This tag will indicate the units of the channel associated with the autonomous message, if that channel is analog.
Associated channel occurrence counter	This tag will indicate the occurrence counter value of the associated with the autonomous message.
Unit identification	This tag will indicate the unit's identification name.
Unit IP address	This tag will indicate the unit's Internet Protocol address.
Date (at condition)	This tag will indicate the date at which the condition occurred.
Date (current)	This tag will indicate the date at which the message was sent.
Time (at condition)	This tag will indicate the time at which the condition occurred.
Time (current)	This tag will indicate the time at which the message was sent.

Using Autonomous Messages

- a) Send an alarm message upon a high voltage condition. Create a message template using tags to insert the value of your battery voltage analog input channel, the date and time at the condition, etc. Then, create schedules to specify where the message is to be sent and which message template to use. Thirdly, configure the binary autonomous message with the schedule to use. Finally, activate the autonomous message on the high voltage binary threshold channel, associating the battery voltage analog input channel to the autonomous message. Hence, when the binary threshold channel turns ON, an alarm message will be sent.
- b) Send a maintenance message after local equipment has failed a certain number of times. Create a message template using tags to insert the value of your equipment failure analog occurrence counter channel, the date and time of the condition, etc. Then, create schedules to specify where the message is to be sent and which message template to use. Thirdly, configure the binary autonomous message with the schedule to use. Finally, activate the autonomous message on the high equipment failure rate binary threshold channel, associating the equipment failure analog occurrence counter channel to the autonomous message. Hence, when the binary threshold channel turns ON, a maintenance message will be sent.
- c) Send an information message when a technician arrives at the telecommunications site. Create a message template using tags to insert the value of your door open channel, the date and time of the condition, etc. Then, create schedules to specify where the message is to be sent and which message template to use. Thirdly, configure the binary autonomous message with the schedule to use. Finally, activate the autonomous message on the technician onsite binary equation channel, associating the door open binary input channel to the autonomous message. Hence, when the binary threshold channel turns ON, an information message will be sent.

CHAPTER 5

Data Logging

Data logging allows you to record site data for further analysis and trending. Data logging produces files that may be downloaded using the iS³'s FTP interface or, more simply, the Web interface.

Binary Data Logging (History File)

The history file records when selected binary channels change state, from ON, OFF, DIS or NA to any state, except for the state change at unit power up. Each state transition is recorded with its corresponding time stamp. All binary transitions are recorded in the same history file. The history file can contain up to 2000 records, stored in reverse chronological order, with the most recent record first.

Using Binary Data Logging Files

- a) Analyze the chronology of a failure. When an important failure happens, it often causes a cascade of events. Since the history file is stored chronologically, you can, through the analysis of events, pinpoint the real cause of a condition and apply the right corrective action.
- b) Analyze the frequency of equipment failure. When a piece of local equipment fails regularly, the problem may lie elsewhere in the telecommunications site, or be linked with another defective piece of equipment. Using the history file records, you can analyze the failures in conjunction with other failure conditions, and identify the root cause of the problem.
- c) Analyze a recurrent alarm. When a parameter in your telecommunications site creates a recurrent alarm condition, it may be linked to other parameters in your site. Using the history file records, you can identify if the problem is time-related (if it occurs always at the same time) or not.

History File Content

The history file will log transitions of all binary channels that are configured with their data logging option enabled. The content of the file, as downloaded from the unit is a CSV formatted file, directly imported in a spreadsheet program. Here is an example of a file that has been downloaded and viewed in ExcelTM:

MULTITEL Inc.				
iS ³ - intelligent Small Site Supervisor				
Software Version	M1.0.0.7			
Unit	iS ³ Demo	Site location		
	02/03/08 11:29			
Binary Data Logging				
Channel	Name	Value	Occurrence	Date Time
BLU1	Supervisor	ON	2	02/03/08 11:29:13
BTH7	High Temp Threshold	OFF	2	02/03/08 11:28:24
BTH5	High Voltage	OFF	1	02/03/07 17:24:00
BTH7	High Temp Threshold	ON	2	02/03/07 17:22:54
BTH5	High Voltage	ON	1	02/03/07 17:22:48
BLU1	Supervisor	OFF	1	02/03/07 10:28:30
BLU1	Supervisor	ON	1	02/03/07 10:12:12
BTH7	High Temp Threshold	OFF	1	02/03/04 14:39:11
BTH7	High Temp Threshold	ON	1	02/03/04 14:30:01

Table 4 - CSV file imported into Excel

History File Reset

History files can be reset from the Web Interface. Before resetting any data logging file, you should download it to make sure no data is lost.

To download or reset a data logging file, simply access your iS³ Web interface and click on the File Transfer link in the left-hand frame. This will display a page of all the files available to be transferred.

To download a file, click on its name and it will be automatically sent to your computer. To reset a file, click on the Reset button. You need proper access rights to reset a data logging file. For more information on access rights, refer to the Users and User Channels section.

Note:

When a binary data logging file attains its maximum recording capacity, every new event will replace the oldest recorded event in the file; following the first-in first-out principle.

Analog Data Logging

The analog data logging offers you the possibility to record analog data in three different types of file. Unlike the binary data logging, which records data only from the binary transitions, this type of data logging allows you to configure the files that will log data from the events that occur in the analog channels. Therefore, you will have access to this important type of monitoring information.

Periodic File

This type of file records values through a period of time defined as Main reference, for example a 24 hour period; then it will calculate, within this main period, the events and measurements that occurred at a more specific and shorter one hour sub periods. That is, the file will record, for example, average values within the sub periods and the average values within the main and broader period. The two possible configurations are 24h/1h and 1h/6min periods.

Each individual periodic data logging file only registers values relative to up to 20 analog channels. It is used to record the following values:

- Average value over the reference period.
- Highest (max) value over the reference period and its time stamp.
- Lowest (min) value over the reference period and its time stamp.
- Highest sub period average value and the associated computation period number in the reference period.
- Lowest sub period average value and the associated computation period number in the reference period.
- The percentage of valid sub-period (normally 100% to indicate that the data logging was running for a full period).

Note:

When an analog periodic data logging file attains its maximum recording capacity, that is the maximum number of periods that was configured, every new period will replace the oldest recorded period in the file; following the first-in first-out principle.

Detailed File

This type of file records detailed data from particular events. In the configuration, specific parameters will be set to focus data logging around specific events throughout two predefined periods of time. When an event occurs, the file starts recording data organized in two possible periods that may be used indistinctively. For example, the source channel turns ON and you want to record values every ten seconds during the following 60 seconds the event occurs. In this case, you can configure the system to record either average values returned throughout the 60 second interval or the fixed value recorded every ten seconds. This function allows for the data recording of up to twenty channels simultaneously.

Note:

When an analog detailed data logging file attains its maximum recording capacity; that is, according to the configured allotted number of recordings for the specific events, every new complete event recording will replace the complete event allotted capacity in the file. However, if recording periods are started but not completed, the file will record each broken period following the first-in first-out principle until the entire file capacity is attained; the it'll start all over again.

Histogram File

This type of file records the time an analog channel was found within a given range of predefined values.

The following is an example of a DLAH (data logging analog histogram). Let's say that one would like to register a battery temperature for an extended period of time. Using an DLAH, the following parameters would be loaded to the system:

- A low value of 0 Celsius
- A high value of 62
- A number of columns (62)

The system would then calculate 62 different ranges of values, all 1 degree Celsius apart: $0 \leq x < 1$, $1 \leq x < 2$, ... up to $61 \leq x \leq 62$. Additional counters would be sub zero temperature occurrences and temperature above 62.

Counters have a resolution of 1 second, for a total duration of registered values of over 136 years per counter.

Note:

There are no recording limits for the analog histogram data logging files. They simply register a value for a maximum period of time of 125 years.

CHAPTER 6

Interfaces to the iS³

The iS³ offers 3 main interfaces: A Web server, an FTP server and an SNMP interface.

The **Web page** is the most commonly used interface, since it only requires an Internet browser to operate. It displays all elements in the system, and offers the possibility to download data logging files.

The **FTP access** permits downloading data logging files and downloading/uploading configuration files. It is recommended to experienced FTP users only, and is available through the MS-DOS prompt on your computer.

The **SNMP agent** is designed to work with your SNMP manager. SNMP is a standard protocol used to manage devices on an IP based Network. SNMP does not provide a user interface per se. The interface is provided by the SNMP Manager (a software running on a computer), whereas the iS³ includes an SNMP Agent. This Agent transmits information that only the SNMP Manager can understand. Then the Manager presents this data to the user.

Access Levels

There are three access levels to the iS³. Please note that each access level includes the rights of lower access levels:

- The **Viewer** level is a read-only access to channels and data. No modification can be made from this access level.
- The **User** level permits resetting data logging and occurrence counters, as well as visualizing channels and data.
- The **Supervisor** level permits viewing, calibrating, and configuring channels, as well as activating the test mode.

Users and passwords are configured using the iS³ Configuration Tool software provided with the iS³. For more information on creating users, consult the iS³ **Configuration Tool** on-line help files.

Using Access Levels

Every time a user accesses the iS³, the system activates a binary channel (mnemonics BLU1 – BLU4). This binary channel can then be used to be aware of specific activity.

Web Interface

The Web interface to the iS³ is used to visualize system statuses and alarms, and to download data logging files.

The iS³'s web page is hosted in the device. It presents, in one screen, all system statuses and alarms. Once logged in, the screen is divided in four parts:

Alarms

Level 1: 2 2: 2 3: 1 4: 0 5: 0 6: 0 7: 0

Environment

Channel Name	Mnemonic	Value	Counter
Fan 1 Fail	U1M1B17	OFF	0
Fan 2 Fail	U1M1B18	ON	0
HVAC Fail	U1M1B19	OFF	0
HVAC ON	U1M1B110	OFF	0
Very High Delta Temp Threshold	BTH3	OFF	0

Channel Name	Mnemonic	Value	Units
Battery String 1 Temperature	U1M1A15	28.32	C
Battery String 2 Temperature	U1M1A16	23.37	C
Ambient Temperature	U1M1A17	21.48	C
Humidity	U1M1A18	48.50	%
Average Battery Temperature	AC1	25.85	C
Delta Temp (Avg Batt - Ambient)	AP1	4.37	C

Figure 11 - Web Interface

The **Header** contains Multitel logo, the site name and active alarms, sorted by level. Each binary channel's alarm level is defined upon its configuration.

The **Main menu** contains links to the alarms page, the download page, the system information page, and derived channels page. It also contains the logoff link, to make sure that no one else than you uses your access codes to the iS³ when you are done. Depending on your system and configuration, this may require that you shut down your Internet browser.

The **Categories menu** contains links specific to the iS³. You will find iS³ channel categories, as defined by the user during configuration, giving access to the channels that belong to each category. In the iS³-3SH section, there is the iS³ hardware information, that is, the physical I/Os found on the device. **If you have proper access rights**, you can remotely calibrate analog channels from the device I/O page, simply by clicking on the calibration icon to the right of the channel. For more information on displaying all configured real channels, read the Calibration section.

The **main screen** displays the information called by clicking on any item in the header, the main menu or the categories and system menu.

Using the Web Interface

To access an iS³'s Web interface, you must launch your Internet browser (such as Internet Explorer or Netscape), and enter the iS³'s IP address in the address text box.

IMPORTANT:

To receive real-time information through the web interface, Internet Explorer must be configured following this procedure;

1. **Start *Internet Explorer*.**
 2. **In the main menu, select *Tools + Internet Options*.**
 3. **In the *Temporary Internet files* dialog box, click on the *Settings* button.**
 4. **In the *Check for newer versions of stored pages* dialog box, select the *Automatically* radio button and click on *OK*.**
 5. **Click on *OK* in the *Internet Options* window.**
-

All iS³s are password-protected, to avoid unauthorized entry and to protect your configuration and data. When your Internet browser connects to the iS³, you will be prompted for a user name and password.

Once a valid user name and password are entered, you will be granted access to the iS³'s Web page. Click on the appropriate icons to visualize alarm levels, system items sorted by category, device physical I/Os, system information, and derived channels information.

Alarms

Alarms are easily accessible by clicking on the Active Alarms link in the main menu, which will take you to the alarms page. This page contains all active alarms in the system. Clicking on the mnemonic of the alarm will take you to the list of likewise channels in your system. For example, if you click on the mnemonic of a binary threshold channel, you will be taken to the binary threshold page.

ACTIVE ALARMS

Test Mode Enable	<u>BFTMODE</u>	Level# 1
Supervisor	<u>BLU3</u>	Level# 1
Controler Fuse Alarm (FA)	<u>U1M1BI3</u>	Level# 2

Figure 12 - Alarms Page

Categories

This menu offers a list of categories. These categories correspond to those created when configuring your iS³. Hence, they can vary along with your specific terminology and requirements.

If you click on any category, you will be taken to a page where all channels associated to this category will be listed.

Categories are a clever way to organize your site information, so that personnel looking for specific data can get to it quickly.

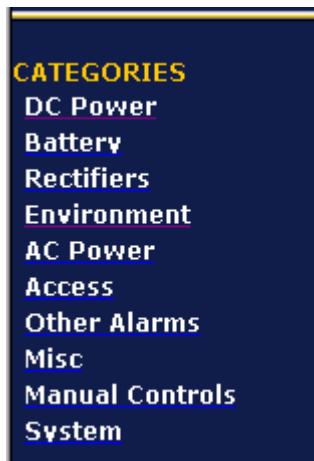


Figure 13 - Categories Menu

System

The System Information page provides basic site information, such as the IP address of the unit, its version, and its date and time.

The System Information page also permits setting the system's date and time easily, to engage and disengage test mode, as well as to reset occurrence counters.

The screenshot shows the 'System Information' page in the iS3 interface. The top navigation bar includes the MULTITEL logo, an 'Alarms' section with a warning icon, and a status bar showing alarm levels (1: 2, 2: 2, 3: 1, 4: 0, 5: 0, 6: 0, 7: 0). The left sidebar contains navigation options like 'Active Alarms', 'File Transfer', 'Derived Channels', 'System Information', and 'Logoff'. Below the sidebar is a 'CATEGORIES' list with items like 'DC Power', 'Battery', 'Rectifiers', etc. The main content area displays system information in a table-like format:

Product Name	iS ³
Unit Name	iS3 Demo
Unit Location	Bell Canada - Montreal
Contact	Yvan Gosselin
Versions	M1.0.0.7, B1.0.0.7, H1.0.0.0
IP Address	209.89.97.237
Subnet Mask	255.255.255.0
Default Gateway	0.0.0.0
MAC Address	00:DD:64:00:00:1D
Date and Time	2002/03/08 11:48:34
Occurrence Counters	<input type="button" value="Reset All"/>
Date	YYYY: <input type="text"/> MM: <input type="text"/> DD: <input type="text"/> <input type="button" value="Set Date"/>
Time	HH: <input type="text"/> MM: <input type="text"/> SS: <input type="text"/> <input type="button" value="Set Time"/>
Test Mode with Locked Outputs	<input type="button" value="Initiate"/>
Test Mode with Unlocked Outputs	<input type="button" value="Initiate"/>

Figure 14 - System Information Page

Downloading

Click on File Transfer to reach the file download page. From there, simply choose the file you wish to download and click on it. The .csv file will be automatically sent to your computer.

The screenshot shows the 'File Transfer' page in the iS3 interface. The page title is 'File Transfer'. Below the title, there is a list of files available for download, each with a small icon and a 'Reset' button on the right:

- [Binary Data Logging](#)
- [Application Configuration File](#)
- [Access Configuration File](#)
- [Device Configuration File](#)

Figure 15 - File Download Page

Calibration

Click on the device I/O module link (in Figure 16, labelled iS³-3SH) to access the hardware information. From there, you can calibrate analog channels by clicking on the calibration icon beside the channel. From the calibration page, you can adjust the offset and the gain simply by entering the value and clicking on the proper button.

The screenshot displays the 'CALIBRATION' page for the 'iS3 Demo' system. At the top, there's a header with the 'MULTITEL' logo and an 'Alarms' section showing levels 1 through 7 with counts (e.g., Level 1: 2, Level 2: 2, Level 3: 1, Level 4: 0, Level 5: 0, Level 6: 0, Level 7: 0). The left sidebar lists navigation options: Active Alarms, File Transfer, Derived Channels, System Information, Logoff, and a list of system components including DC Power, Battery, Rectifiers, Environment, AC Power, Access, Other Alarms, Misc, Manual Controls, and System. The 'iS3-3SH' device is selected. The main content area is titled 'CALIBRATION' and features a table with the following data:

Channel Name	Current Reading	Full Scale	Status
Plant Volatge	55.70	70	

Below the table, the calibration process is outlined in four steps:

- Step 1 : Apply "Zero" input value on channel pins (offset)
- Step 2 : Applied "Zero" input value on channel :
- Step 3 : Apply known input value on channel pins (Gain)
- Step 4 : Applied known input value on channel pins :

Figure 16 - Calibration Page

Test Mode

The test mode permits validating if logical relations within your system work properly. For example, you can verify that an e-mail is correctly sent to a user when a certain alarm is activated.

The Test Mode page is accessible through the System Information page. Simply click on the Start link next to Test Mode Locked.

Once in the Test Mode page, you can change the state of binary channels (to ON, OFF, NA, DIS, OVL+, or OVL-), as well as modify the value of analog channels. Select the channel from the drop-down Channel List, then set a New Value and click on Set. The value of the channel will be changed. In test mode, it is possible to choose whether the binary outputs must be activated or not.

IMPORTANT:

It should not be forgotten that when operating in Test Mode, false alarms can be generated.

Only users with Supervisor access can activate test mode. Once the Supervisor logs off, all channels in test mode return to normal mode and their actual values.

The screenshot displays the 'TEST MODE' interface. At the top, the 'Alarms' section shows a level indicator: Level 1: 6, 2: 3, 3: 1, 4: 0, 5: 0, 6: 0, 7: 0. The main content area is titled 'TEST MODE' and contains a table for 'Channel List' with columns for 'Channel List', 'Current Value', and 'New value'. A dropdown menu is open for 'U1M1BI7 - Fan 1 Fail', showing 'OFF' in the 'Current Value' field and an empty 'New value' field, with a 'Set' button to the right. Below the table is a 'Reset and Quit Test Mode' button. A section titled 'Outputs Locked' shows 'Channels in Test Mode' with a table listing 'U1M1BI6 - RFA 4' with a 'Set Value' of 'ON' and a 'Remove' button to the right.

Figure 17 - Test Mode Page

FTP Interface

The FTP interface provides a very simple access to downloading configuration and data logging files. It requires an MS-DOS prompt and entering commands manually.

Using the FTP Interface

To access the iS³ through its FTP interface, you must launch the MS-DOS prompt on your computer.

At the Windows prompt, enter the following command:

```
ftp xxx.xxx.xxx.xxx
(yyy.yyy.yyy.yyy corresponds to the iS3's IP address)
```

All iS³s are password-protected, to avoid unauthorized entry and to protect your configuration and data. When you connect to the iS³, you will be prompted for a user name and password. Once a valid user name and password have been entered, you are granted access to the FTP interface.

Four commands are available:

dir is used to display the files available for download.

get is used to download files from the iS³.

put is used to upload new files to the iS³.

quit is used to terminate your FTP session.

Examples:

```
ftp> dir
200 Command OK
150 Here it comes...
Name                Size      Time      Date      Flag      Crc
-----
DLB.csv              384      11:43:05  2003/06/03  rw--      ????
CHAN.CSV             0         11:43:05  2003/06/03  r---      ????
CFG_APP.XMD          3968     15:23:44  2003/05/30  rw--      BA6F
CFG_ACC.XMD           256     15:23:44  2003/05/30  rw--      9E4B
CFG_DEV.XMD           768     15:23:44  2003/05/30  rw--      F86C
CODEMAIN.XMD        655360   14:39:11  2003/04/08  -w--      C10B
-----

Number of files:          6 Total Bytes: 660736

226 Transfer OK, Closing connection
ftp: 638 bytes received in 0,02Seconds 31,90Kbytes/sec.

ftp> get cfg_app.xmd
200 Command OK
150 Here it comes...
226 Transfer OK, Closing connection
ftp: 3968 bytes received in 0,09Seconds 44,09Kbytes/sec.

ftp> put cfg_app.xmd
200 Command OK
150 Connecting for STOR
226 Transfer OK, Closing connection
ftp: 3968 bytes sent in 0,00Seconds 3968000,00Kbytes/sec.

ftp> quit
221 Bye
```


SNMP Interface

SNMP is a machine-to-machine interface. To use SNMP, the iS³ MIB must be integrated into the SNMP manager to interface to. For more information, talk to a Multitel representative. Note that the integration into the industry standard HP OpenView SNMP Manager provided with the unit is done using a simple script.

The iS³ SNMP agent supports “TRAPS” and “GETS”, but not “SETS.” For more information on using the SNMP agent, contact Multitel customer service.

CHAPTER 7

Pass-Through

This chapter will explain the pass-through capability of the iS³. This function is easy to set up and provides a way to connect legacy devices to an Ethernet network (LAN).

Pass-Through Definition

We can define pass-through as a way to transform a legacy device simple serial port into an Ethernet port, using the iS³. This port then provides access to IP networks since the means used to transport data is TCP/IP.

The figure below shows the principle. This iS³ functionality is equivalent to what “terminal server” devices will provide. Note that when enabling and using the pass-through capability of the iS³, every other function of the iS³ (data acquisition, derived channel evaluation, Web interface, etc.) still continues to operate normally.

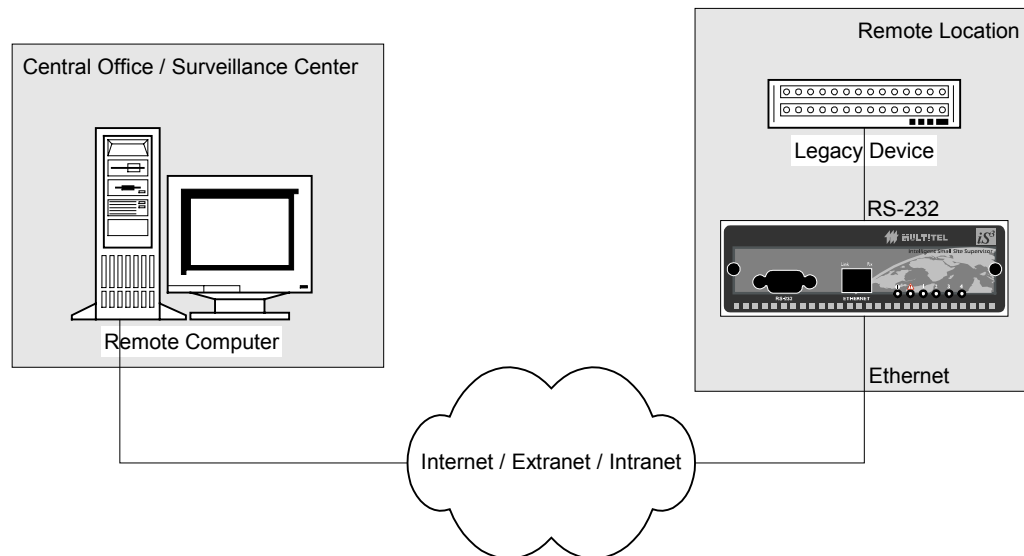


Figure 18 - Pass-through schematics

How Does Pass-Through Work

When enabled and properly configured, the pass-through will have a TCP port “listening” for an incoming request to establish a connection. If the third party knows the IP address of the iS³ and the TCP port number that was configured for pass-through, then this third party will be able to emit a request for a connection.

After accepting the request, the iS³ then establishes a totally transparent link between the TCP (Ethernet) port and the configured serial port. The connection will end at the moment the third party will “drop” the connection on its end. Note that if the pass-through is inactive for 45 seconds (configurable), the iS³ will automatically drop the connection. The third party will be informed of the connection being dropped.

A pass-through connection can also be established by the iS³, if configured to act this way. If instructed to automatically establish a connection, the iS³ will listen on the serial port. If it sees an incoming character, the iS³ will try to establish a connection on the TCP side to a third party listening on a predetermined port. This is usually only enabled if the iS³ is connected to a device that could transmit alarms or callouts by itself and needs to send these to some IP address.

Note that both ways of establishing a connection can be programmed to work concurrently.

Specific Pass-Through Parameters

The pass-through parameters are the following:

Enabled:	Indicates if the pass-through is enabled or not
Local TCP port number:	To enable a third party (computer) to establish a pass-through connection, you need to specify which TCP port will be used. This is the TCP port the iS ³ will “listen” to.
Remote IP address AND Remote TCP port number:	If left blank, the iS ³ will never establish a connection when an incoming character is detected on the serial port using pass-through. If both are properly configured, the iS ³ will be able to try establishing pass-through connection by itself when some activity is detected on the serial port involved in the pass-through.
Inactivity Timeout:	Time during which there is no activity. At the term of this time the connection is dropped.

Configuring Pass-Through

To use the pass-through feature, you first have to enable and configure it, using the **iS³ Configuration Tool**. Refer to the **iS³ Configuration Tool** on-line help files to see exactly how to perform this action.

Using the Serial Ports Involved in Pass-through

Since pass-through establishes a point-to-point connection between a third party (remote computer) and a serial device, the serial port of the iS³ obviously needs to be permanently connected to the local legacy device. This means that this serial port cannot be used for any other task, namely to send autonomous messages.

CHAPTER 8

Configuring the iS³

The iS³ is very flexible and customizable, enabling you to tailor it to your site's needs and requirements. To help you achieve this task, a configuration software is available, the **iS³ Configuration Tool**. This user-friendly software contains help files to guide you through the configuration process.

For more information on configuring the iS³, consult the **iS³ Configuration Tool** on-line help files, provided with the iS³.

CHAPTER 9

Installing the iS³

The iS³ was designed to be easy to install, with a minimum number of tools and connections required. To guide you through the installation process, read the Installation Guide provided with the iS³.

CHAPTER 10

Maintenance

The iS³ monitoring system requires little maintenance. Except for the replacement of the memory back-up battery, there are no field replaceable parts inside the unit.

Back-up Battery

CAUTION: do not attempt any other repair than changing the back-up battery. If any problem persists, contact the closest approved maintenance center.

The data logged during the iS³ operation is kept in a memory which is protected against accidental erasure for at least 300 days by a lithium back-up battery. Under no drain, this battery has a life expectancy of more than ten years.

The battery is automatically tested once a week by the system. When the battery is detected weak, an alarm is generated, materialized by the following events:

- The FAIL relay falls into a fail status,
- The FAIL LED located on the front panel starts blinking,
- A “Lithium Fail Alarm” is generated on the Web Page,
- If so configured, by assigning a Derived Channel to the battery alarm event, the system generates a SNMP trap message, an e-mail, and/or a call-back.

CAUTION:

Equipment protection

This equipment contains discrete and micro-electronic solid state devices subject to permanent damage due to electrostatic potentials which may occur during handling and installation unless proper personnel grounding procedures are observed.

CAUTION:

DO NOT ATTEMPT TO RECHARGE THE BATTERY !

Danger of explosion if user attempts to recharge the battery or if the replacement is not done correctly.

Replace only with the same (CR2032) or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

To replace the battery, follow the steps described below.

The recommended battery type is CR2032, which is a widely used and readily available type of lithium battery. If done properly, replacing the battery is a simple operation.

IMPORTANT:

The battery replacement must be performed from the rear of the unit. Internal wiring to the rear plate prevents removing the main board from the front.

Memory back-up battery replacement.

Step	Action
1	Since removing the battery requires shutting the unit down, all backed-up data will be lost upon removal of the battery. Therefore, important data must be retrieved prior to performing this operation. Proceed as described in the user manual to retrieve the data.
2	Disconnect interface and power connectors from the back of the unit. IMPORTANT: The iS ³ can be damaged by electrostatic discharges. Therefore, it must be open at an ESD safe workstation which requires an ESD bracelet and a dissipative surface both properly grounded. Make sure you place the iS ³ internal circuitry on the dissipative surface.
3	Unscrew the two screws fixing the rear plate.
4	Unscrew the nuts retaining the RS-232 connector(s) to the front plate.
5	Remove the rear plate and the electronics together; the boards are attached to the rear plate by a ground wire. Do not detach this wire.
6	Remove the old battery by pulling it out of its socket. The battery is seated vertically near the front of the unit. To remove, gently push the top of the battery towards the edge of the board to dislodge it from the socket and pull it up to slide it out.
7	Install the new battery, observing the polarity. The positive side (case) must be directed towards the center of the board. Avoid manipulating the new battery with bare fingers, since this may deposit organic residues that create a leakage path and reduce battery life. If this cannot be avoided, carefully wipe the new battery free of any residues before inserting it into the socket.
8	Carefully slide the board assembly into the enclosure, paying attention to properly insert the board(s) into the grooves.
9	Reinstall the rear plate and tighten the two screws.
10	Reinstall and tighten the nuts retaining the RS232 connector(s) on the front plate.
11	Reconnect the connectors.
12	Power the unit up, reset time and date and reinitialize statistics as described in the user manual.

Calibration

Analog channels are calibrated at the time of manufacturing. No further calibration should normally be required. Contact Multitel if any calibration is needed.

Troubleshooting

This section provides a list of the problems that may occur and their probable causes. Should a problem occur in the operation of the iS³ monitor, the first step in the troubleshooting process is to verify the system setup through the configuration files. If you don't find the cause of the problem there, refer to the following troubleshooting procedures. If a problem cannot be identified with these procedures, please contact the nearest approved maintenance center.

Problems in the iS³ may be divided in two categories:

- The unit is still accessible through its communication ports; these problems are usually detected by the internal software.
- The unit appears dead, no communication is possible, with or without any alarm indication.

Troubleshooting with communication

The internal software continuously performs a self test of all hardware peripherals and sets the system alarms accordingly. If an internal problem is detected, the FAIL LED on the front panel starts flashing and the FAIL relay is set to the Fail position. The active alarms are then available on the Web Page. More on the system channels can be found in the user manual.

SYSTEM CHANNEL NAME	MEANING	COMMENT
System Fault	Global system fault.	Turns ON if any other system fault channel turns ON
System CPU Reset	CPU reset	CPU reboot or unit power-up
System Int. Modem/RS-232 DEVICE DTE Port Fault	Internal modem failure	
System Ethernet Port	Ethernet port failure	
System Module	Module (main or add-on) failure	
System Real Time Clock	RTC failure or not initialized	
System Lithium Cell Fault Or Low	Low or bad Lithium battery	
System RS-232 CRAFT DCE Port Fault	RS-232 CRAFT DCE port failure	
System Test Mode Active	Test mode is active	Not a failure

System Configuration File	Configuration file problem	Possible causes: Invalid file CRC, Size out of range, Invalid content, Configuration does not match hardware options
System Date	Date changed	Not a failure Turns ON and OFF rapidly. Tracks date changes.
System EEPROM	EEPROM chip faulty	Usually unable to write to EEPROM or checksum error.
System Upload File	Successful file upload(s)	Not a failure

An internal failure cannot be fixed in the field.

Analog channel troubles

Fault Symptom	Conditions	Possible causes
The system detects an erratic value on an analog channel.	Upon installation:	Bad channel configuration: Check channel configuration in iS ³ Configuration Tool.
	Anytime:	Defective sensor (if any); replace sensor Poor connection; check for corroded contacts or damaged wires.
The system detects a wrong value on an analog channel.	Upon Installation:	Bad channel configuration: check scale in iS ³ Configuration Tool
		Bad calibration: check channel offset and gain; eventually recalibrate channel.
	Anytime:	Wrong signal; verify.
		Defective sensor (if any); check signal value, replace sensor accordingly Channel interface failure: contact maintenance center.

Event channel troubles

Fault Symptom	Conditions	Possible causes
The system does not detect an event properly.	Upon installation:	Bad channel configuration: Check channel configuration in iS ³ Configuration Tool matches your event (type and active configuration).
	Anytime:	Defective sensor (if any); replace sensor
		Defective connection; check for corroded contacts or damaged wires. Channel interface failure: contact maintenance center.

Output channel troubles

Fault Symptom	Conditions	Possible causes
The system does not control an output channel.	Upon installation:	Bad channel configuration: Check channel configuration in iS ³ Configuration Tool (channel binding).
	Anytime:	Defective connection; check for corroded contacts or damaged wires.
		Channel interface failure: contact maintenance center.

Modem troubles

Fault Symptom	Possible causes
The modem does not answer when the telephone line rings.	There is a connection problem. Verify that the tip and ring leads are connected to the two center pins of the RJ11 jack.
	Verify the telephone number.
	The remote equipment is failed and does not return the originate carrier. Verify.
	The remote equipment is incorrectly configured. Verify the parameters.
The modem answers the call but the communication is erratic.	The iS ³ internal modem has failed. Contact maintenance center.
	The protocol is not properly set.
	The telephone line is too noisy. Try using a lower baud rate.
	The telephone line is used by another equipment. Verify.
The modem remote port answers the line but strange characters are received.	The remote equipment has failed.
	The emulation on the remote equipment is incorrect (DEC VT100)
	The telephone line is too noisy. Try using a lower baud rate.
	The telephone line is used by another equipment. Verify.
	The communication protocol parameters do not match.

RS232 Port troubles

Fault Symptom	Possible causes
RS-232 CRAFT DCE link is inoperative.	Wrong protocol or baud rate settings. Verify that the baud rate of your equipment matches the baud rate of the iS ³ port.
	The external equipment is DCE: use a crossed cable.
	The external equipment is DTE: use a direct cable.
	The cable is damaged; verify that all required connections are correct.
	The iS ³ internal port has failed. Contact maintenance center.
	The RS-232 CRAFT DCE port does not support neither hardware nor software flow control.
RS-232 DEVICE DTE link is inoperative.	The external equipment has failed. Verify.
	Wrong protocol or baud rate settings. Verify that the baud rate of your equipment matches the baud rate of the iS ³ port.
	The external equipment is DTE: use a crossed cable.
	The external equipment is DCE: use a straight cable.
	The cable is damaged; verify that all required connections are correct.
	The iS ³ internal port has failed. Contact maintenance center.
	The external equipment has failed. Verify.

The RS-232 link operates but generates strange characters.	Verify that the protocols and baud rates of the iS ³ port and the external equipment are set to the same parameters.
	One of the control signals is floating. Verify the cable.
RS-232 CRAFT DCE link does not answer when connected to an external Modem.	This is normal; the local RS-232 port does not support modem control.
RS-232 DEVICE DTE link does not answer when connected to an external Modem.	The cable between the modem and the RS-232 port is not connected properly.
	Wrong baud rate settings. Verify that the baud rate of the modem matches the baud rate of the iS ³ port.
	Verify for the possible cause according to the "Modem troubles" table above.
	The cable connecting the modem is the wrong type. Contact maintenance center for advice.

Ethernet Port troubles

Fault Symptom	Possible causes
LED link is extinguished.	The cable is not connected, or defective, or the equipment connected to the iS ³ is OFF.
	The cable is crossed.
	The Ethernet system to which the iS ³ is connected does not send periodic link test pulses.
Rx LED does not flash when connection is attempted.	The cable is defective, or the equipment connected to the iS ³ is OFF. Verify with another cable.
	Wrong configuration: verify that IP address, subnet mask and gateway are set properly. (Please refer to Installation manual for proper settings)
	The iS ³ Ethernet port has failed. Contact maintenance center.
LED seem fine, but the iS ³ does not communicate with a laptop or PC.	Wrong cable; use a crossed cable for a direct connection, and a direct cable when connected to a hub.
	Wrong settings: The laptop or PC must have a fixed IP address. Verify.

Troubleshooting without communication.

Fault Symptom	Possible causes
All LEDs are extinguished.	No power is applied to the unit. Verify that voltage is present on the power input terminals.
	Input voltage is too low: the iS ³ power supply operates with a hysteresis. The input voltage must be higher than 44.5 Volts to start the unit. Once started, the voltage may drop down to 38 Volts before the unit shuts down. For 24 Volt units, the input voltage must be higher than 21.3 Volts to start the unit. Once started, the voltage may drop down to 18Volts before the unit shuts down.
	Unit is defective. Contact maintenance center.
One or more LEDs are on, but unit does not work.	The unit is locked; this situation is not normally possible since the iS ³ is equipped with a watchdog circuit which resets the unit. Try shutting the unit OFF and ON again.
	Unit is defective. Contact maintenance center.

CHAPTER 11

Contacting MULTITEL

Our Customer service and Technical support technicians are always ready to answer any questions you may have about this product.

Simply call, write to us or visit our Internet site where you will also find FAQ's for the iS³.



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Quebec, QC G1P 2J2 CANADA**

(418) 847-2255

Call us toll-free at 1-888-685-8483

<http://www.multitel.com/>

<mailto:support@multitel.com>

CHAPTER 12

Appendix A

OPERATION	OPERATOR	OPERANDS	TRUTH TABLE (ANY ORDER)
And	& or *	2	ON & ON = ON ON & OFF = OFF ON & DIS = ON ON & NA = NA OFF & OFF = OFF OFF & NA = OFF OFF & DIS = OFF NA & NA = NA NA & DIS = NA DIS & DIS = DIS
Or	 or +	2	ON + ON = ON ON + OFF = ON ON + NA = ON ON + DIS = ON OFF + OFF = OFF OFF + NA = NA OFF + DIS = OFF NA + NA = NA NA + DIS = NA DIS + DIS = DIS
Not	!	1	!ON = OFF !OFF = ON !DIS = DIS !NA = NA
Xor	^	2	ON ^ ON = OFF ON ^ OFF = ON ON ^ NA = NA ON ^ DIS = ON OFF ^ OFF = OFF OFF ^ NA = NA OFF ^ DIS = DIS NA ^ NA = NA NA ^ DIS = NA DIS ^ DIS = DIS

Table 5 - Binary channel truth table

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