GE Industrial Systems

RRTD Remote RTD Module

Instruction Manual

RRTD Revision: 59CMB151.000

Manual P/N: 1601-0104-B6

GE Multilin

215 Anderson Avenue, Markham, Ontario

Canada L6E 1B3

Tel: (905) 294-6222, 1-800-547-8629 (North America)

Fax: (905) 201-2098

Internet: http://www.GEindustrial.com/multilin

Manufactured under an
ISO9001 Registered system.

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1.1.1 DESCRIPTION

The Remote RTD Module (RRTD) provides additional RTD temperature metering capabilities for GE Multilin relays such as the 369 Motor Management Relay.

The RRTD module is a 'black box' which monitors up to 12 RTDs and can be polled for information. All RRTD setpoint programming is accomplished via the 369 over the serial communication link or by other devices using the Modbus RTU protocol. Communications connections are over a shielded twisted pair RS485 connection or via the fiber optic port.

The RRTD module has been designed to be mounted close the motor to facilitate reduced length of RTD wiring. A 369 Motor Management Relay can then monitor the RTDs from a remote location and use this temperature information for protection/metering purposes.

The RRTD has three RS485 ports. The Modbus RTU protocol is standard to all ports. The Fiber Optic port and Profibus protocol are optional features of the RRTD.

Optional output relays, digital inputs, and analog outputs are also provided (see pages 2–5 to 2–6 for additional details). These features allow for addition control and provide stand alone overtemperature protection. The RTDPC program is used to program setpoints and monitor actual values if the RRTD is operated as stand alone. A Quick Panel display may be used to monitor temperatures.

RRTD options are available when ordering the relay or as upgrades to the relay in the field. Field upgrades are via an option enabling passcode available from GE Multilin, which is unique to each relay and option.

1.1.2 ORDERING

Select the basic model and the desired features from the selection guide below:

RRTD	✳	✳	✳	
RRTD	|	|	|	Base unit
	HI	|	|	50 to 300 V DC / 40 to 265 V AC control power
	LO	|	|	20 to 60 V DC / 20 to 48 VAC control power
		IO	|	Optional Input and Output
		0	|	No optional Input and Output
			F	Optional Fiber Optic port
			0	No optional Fiber Optic port

Notes: The control power (HI or LO) must be specified with all orders. If a feature is not required, a 0 must be placed in the order code. All order codes have 9 or 10 digits.

Examples: **`RRTD-HI-IO-0`** RRTD with HI voltage control power and IO option
`RRTD-LO-0-F` RRTD with LO voltage control power and fiber optic port

Location:
GE Multilin
215 Anderson Avenue
Markham, Ontario
Canada L6E 1B3
Tel: (905) 294-6222, 1-800-547-8629 (North America)
Fax: (905) 201-2098
Web Page: http://www.GEindustrial.com/multilin; e-mail: info.multilin@indsys.ge.com

1.1.3 REVISION HISTORY

Table 1–1: FIRMWARE REVISION HISTORY

REVISION	DESCRIPTION OF CHANGES	RELEASE DATE
59CMB110.000	Production Release	October 15, 1999
59CMB120.000	Improvements to Channel 3 communications	January 3, 2000
59CMB140.000	Improved method of downloading setpoint files	February 16, 2000
59CMB151.000	Changes to communications	October 18, 2002

Table 1–2: SOFTWARE REVISION HISTORY

REVISION	DESCRIPTION OF CHANGES	RELEASE DATE
1.10	Production Release	October 15, 1999
1.20	PC software for new firmware	January 3, 2000
1.40	Implemented refresh RRTD setpoints command	February 16, 2000
1.51	Changes to Channel communications	October 18, 2002

1.1.4 FUNCTIONAL SUMMARY

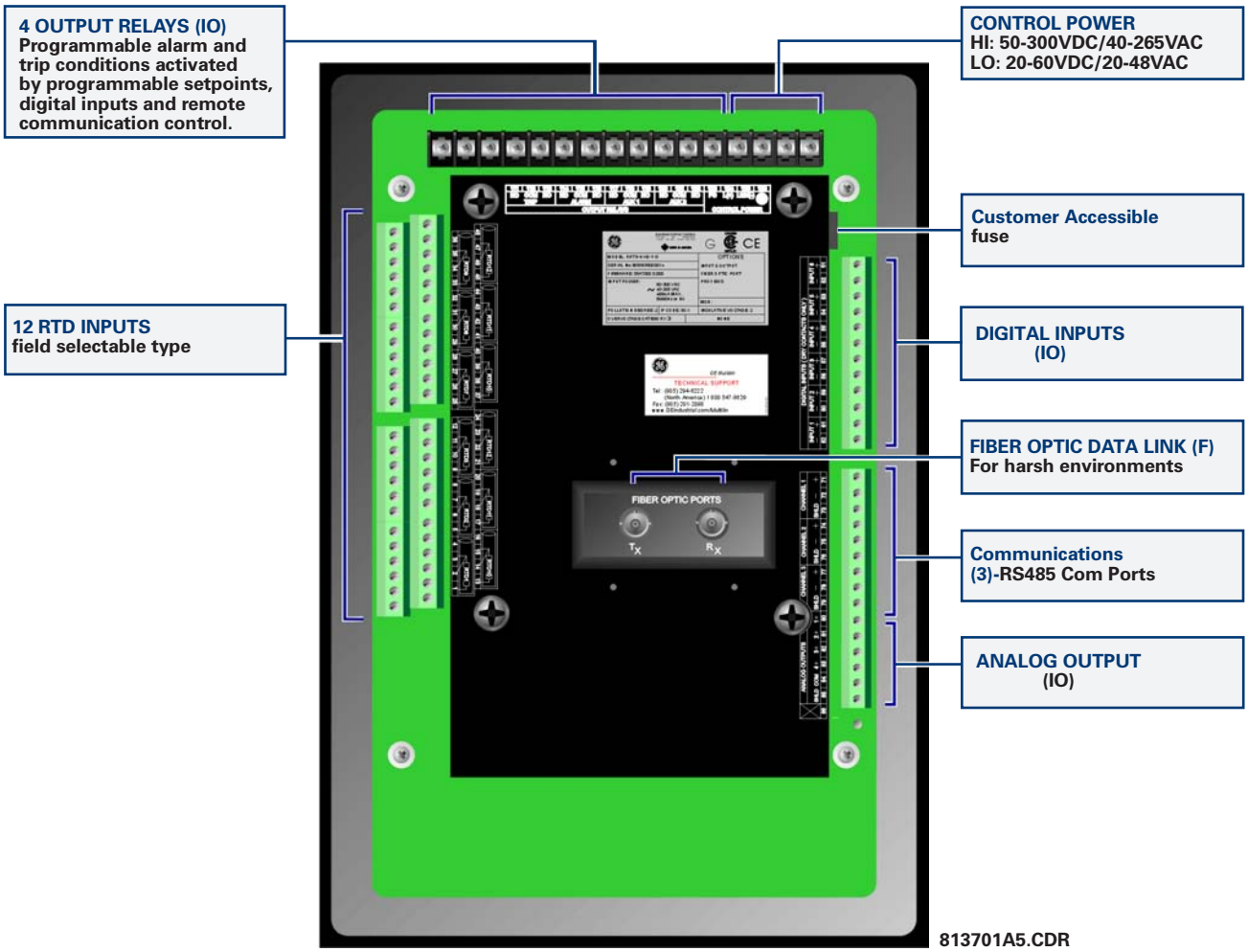
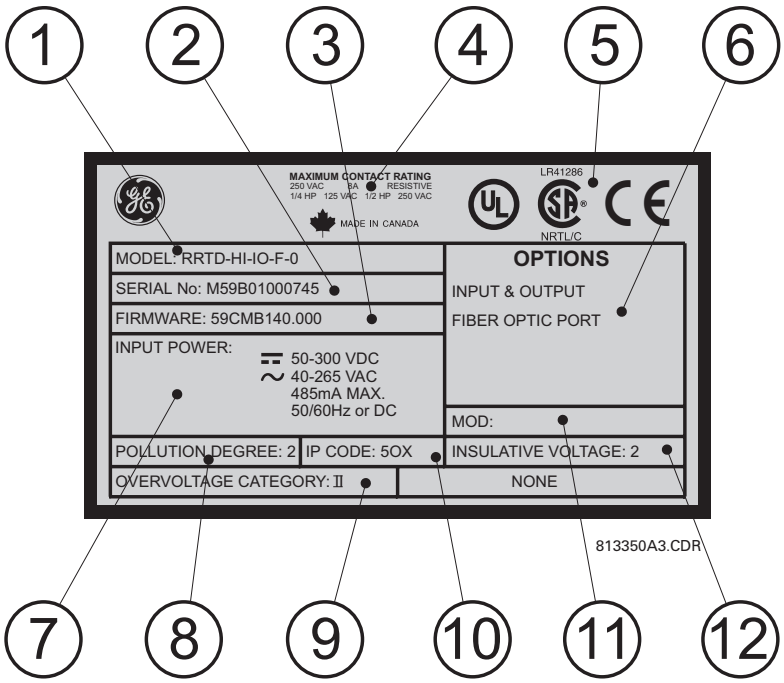


Figure 1–1: FUNCTIONAL VIEW



1. The RRTD order code at the time of leaving the factory.
2. The serial number of the RRTD.
3. The firmware that was installed in the RRTD when it left the factory. Note that this may no longer be the current firmware as firmware may be upgraded in the field. The current firmware revision may be checked via the RTDPC program.
4. Specifications for the output relay contacts.
5. Certifications the RRTD conforms with or has been approved to.
6. Factory installed options. These are based on the order code. Note that the RRTD may have had options upgraded in the field. The Actual Values section of the RTDPC may be checked to verify this.
7. Control power ratings for the RRTD as ordered. Based on the HI/LO rating from the order code.
8. Pollution degree.
9. Overvoltage Category.
10. IP code.
11. Modification number for any factory ordered mods. Note that the RRTD may have had modifications added in the field. The Actual Values section of the RTD PC may be checked to verify this.
12. Insulative voltage rating.

1.2.1 DESCRIPTION

The Remote RTD module shall be capable of monitoring up to 12 three wire shielded RTDs. Each RTD input is to be individually field programmable to type (that is, 100P, 100N, 120N, or 10C). The Remote RTD shall be capable of being daisy-chained with 4 other RRTD modules to provide monitoring and protection of up to 60 RTDs.

The communication interface includes 3 independent RS485 ports and a fiber optic port. Modbus RTU is to be the standard protocol.

The module shall be accompanied by supporting PC software, thus allowing easy programming and monitoring. The module shall be capable of automatically communicating the RTD information to the 369 Motor Management Relay.

1.2.2 PROTECTION FEATURES

ANSI/IEEE DEVICE	PROTECTION FEATURES	TRIP	ALARM
38	Bearing RTD	✔	✔
49	Stator RTD	✔	✔
	Ambient RTD	✔	✔
	Short/Low Temperature RTD		✔
	Broken/Open RTD		✔
	Loss of RRTD Communications		✔
	Self-Test/Service		✔

1.2.3 METERED QUANTITIES

METERED QUANTITY	UNITS	OPTION
Input Switch Status	Open / Closed	IO
Relay Output Status	(De) Energized	IO
RTD Temperature	°C or °F	

1.2.4 ADDITIONAL FEATURES

FEATURE	OPTION
Modbus RTU Communications Protocol	
User Definable Baud Rate (1200 to 19200)	
Flash Memory for easy firmware updates	
Rear RS485 communication port	
Rear fiber optic port	F
RTD type is user definable	
4 User Definable Analog Outputs (0 to 1 mA, 0 to 20 mA, 4 to 20 mA)	IO
Windows based PC software for setup and monitoring	

Specifications are subject to change without notice.

1.3.1 INPUTS

CONTROL POWER

LO range: DC: 20 to 60 V DC
AC: 20 to 48 V AC at 50/60 Hz

HI range: DC: 50 to 300 V DC
AC: 40 to 265 V AC at 50/60 Hz

Power: nominal: 20 VA; maximum: 65 VA

Holdup: non-failsafe trip: 200 ms; failsafe trip: 100 ms

FUSE

T 3.15 A H 250 V (5 × 20 mm); Timelag high breaking capacity

DIGITAL / SWITCH INPUTS (IO option)

Inputs: 6 optically isolated

Input type: Dry Contact (< 800 Ω)

Function: Programmable

RTD INPUTS

Wire Type: 3 wire

Sensor Type: 100 Ω platinum (DIN 43760), 100 Ω nickel, 120 Ω nickel, 10 Ω copper

RTD sensing current: 3 mA

Range: –40 to 200°C or –40 to 392°F

Accuracy: ±2°C or ±4°F

Lead Resistance: 25 Ω max. for Pt and Ni type; 3 Ω max. for Cu type

Isolation: 36 Vpk

1.3.2 OUTPUTS

ANALOG OUTPUTS (IO option)

	PROGRAMMABLE		
OUTPUT	0 to 1 mA	0 to 20 mA	4 to 20 mA
MAX LOAD	2400 Ω	600 Ω	600 Ω
MAX OUTPUT	1.01 mA	20.2 mA	20.2 mA

Accuracy: ±1% of full scale

Isolation: 50 V isolated active source

OUTPUT RELAYS (IO option)

	RESISTIVE LOAD (pf = 1)	INDUCTIVE LOAD (pf = 0.4)(L/R - 7ms)
RATED LOAD	8 A at 250 V AC 8 A at 30 V DC	3.5 A at 250 V AC 3.5 A at 30 V DC
CARRY CURRENT	8A	
MAX SWITCHING CAPACITY	2000 VA 240 W	875 VA 170 W
MAX SWITCHING V	380 V AC	125 V DC
MAX SWITCHING I	8 A	3.5 A
OPERATE TIME	<10 ms (5 ms typical)	
CONTACT MATERIAL	silver alloy	

1.3.3 COMMUNICATIONS

BACK PORTS (3)

Type: RS485

Baud Rate: 1200 to 19200 baud

Protocol: Modbus® RTU

Isolation: 36 V (together)

FIBER OPTIC PORT (F option)

Optional Use: RTD remote module hookup

Baud Rate: 1200 to 19200 baud

Protocol: Modbus® RTU

Fiber Sizes: 50/125, 62.5/125, 100/140, and 200 µm

1.3.4 PROTECTION ELEMENTS

38/49 RTD and RRTD PROTECTION

Pickup Level: 1 to 200°C or 34 to 392°F

Pickup Accuracy: ±2°C or ±4°F

Dropout Level: 96 to 98% of pickup above 80°C

Time Delay: <5 s

OPEN RTD ALARM

Pickup Level: detection of an open RTD

Pickup Accuracy: >1000 Ω

Dropout Level: 96 to 98% of pickup

Time Delay: <5 s

SHORT/LOW TEMP RTD ALARM

Pickup Level: <–40°C or –40°F

Pickup Accuracy: ±2°C or ±4°F

Dropout Level: 96 to 98% of pickup

Time Delay: <5 s

LOSS OF RRTD COMMS ALARM

Pickup Level: no communication

Time Delay: 2 to 5 s

1

GENERAL SWITCH

Time Delay: 0.1 to 5000.0 s in steps of 0.1
Start Delay: 0 to 5000 s in steps of 1
Timing Accuracy: ±200 ms or ±0.5% of total trip time, whichever is greater

DIGITAL COUNTER

Pickup: on count equaling level
Time Delay: <200 ms

TRIP COUNTER

Pickup: on counting equalling level
Time Delay: <200 ms

1.3.5 ENVIRONMENTAL

AMBIENT TEMPERATURE

Operating Range: –40°C to +60°C
Storage Range: –40°C to +80°C

HUMIDITY

Up to 95% non condensing

DUST/MOISTURE

IP50

VENTILATION

No special ventilation required as long as ambient temperature remains within specifications. Ventilation may be required in enclosures exposed to direct sunlight.

OVERVOLTAGE CATEGORY II

CLEANING

May be cleaned with a damp cloth.

NOTE

The 369 must be powered up at least once per year to prevent deterioration of electrolytic capacitors.

1.3.6 APPROVALS / CERTIFICATION

ISO: Designed and manufactured to an ISO9001 registered process.
CSA: CSA approved
UL: UL recognized
CE: Conforms to EN55011/CISPR 11, EN50082-2, IEC947-1, 1010-1

1.3.7 TYPE TESTING

SURGE WITHSTAND CAPABILITY

ANSI/IEEE C37.90.1 Oscillatory (2.5 kV/1 MHz)
ANSI/IEEE C37.90.1 Fast Rise (5 kV/10 ns)
IEC EN61000-4-4, Level 4

INSULATION RESISTANCE

IEC255-5

IMPULSE TEST

Per IEC 255-5 Section 8

DIELECTRIC STRENGTH

ANSI/IEEE C37.90; IEC 255-6; CSA C22.2

ELECTROSTATIC DISCHARGE

EN61000-4-2, Level 3; IEC 801-2

SURGE IMMUNITY

EN61000-4-5

CURRENT WITHSTAND

ANSI/IEEE C37.90; IEC 255-6

RFI

ANSI/IEEE C37.90.2, 35 V/m; EN61000-4-3; EN50082-2 at 10 V

CONDUCTED/RADIATED EMISSIONS

EN 55011 (CISPR 11)

TEMPERATURE/HUMIDITY WITH ACCURACY

ANSI/IEEE C37.90; IEC 255-6; IEC 68-2-38 Part 2

VIBRATION

IEC 255-21-1 Class 1; IEC 255-21-2 Class 1

VOLTAGE DEVIATION

EN61000-4-11

MAGNETIC FIELD IMMUNITY

EN61000-4-8

1.3.8 PRODUCTION TESTING

DIELECTRIC STRENGTH

All high voltage inputs at 2 kV AC for 1 minute

BURN IN

8 hours at 60°C sampling plan

CALIBRATION AND FUNCTIONALITY

100% hardware functionality tested
100% calibration of all metered quantities

2.1.1 DESCRIPTION

The RRTD is contained in a compact plastic housing with the keypad, display, communication port and all indicators/targets on the front panel. The physical dimensions and mounting (drill diagram) are shown below. Mounting hardware consisting of bolts and washers are provided with the module.

Although it is internally shielded to minimize noise pickup and interference, the RRTD should be mounted away from high current conductors or sources of strong magnetic fields.

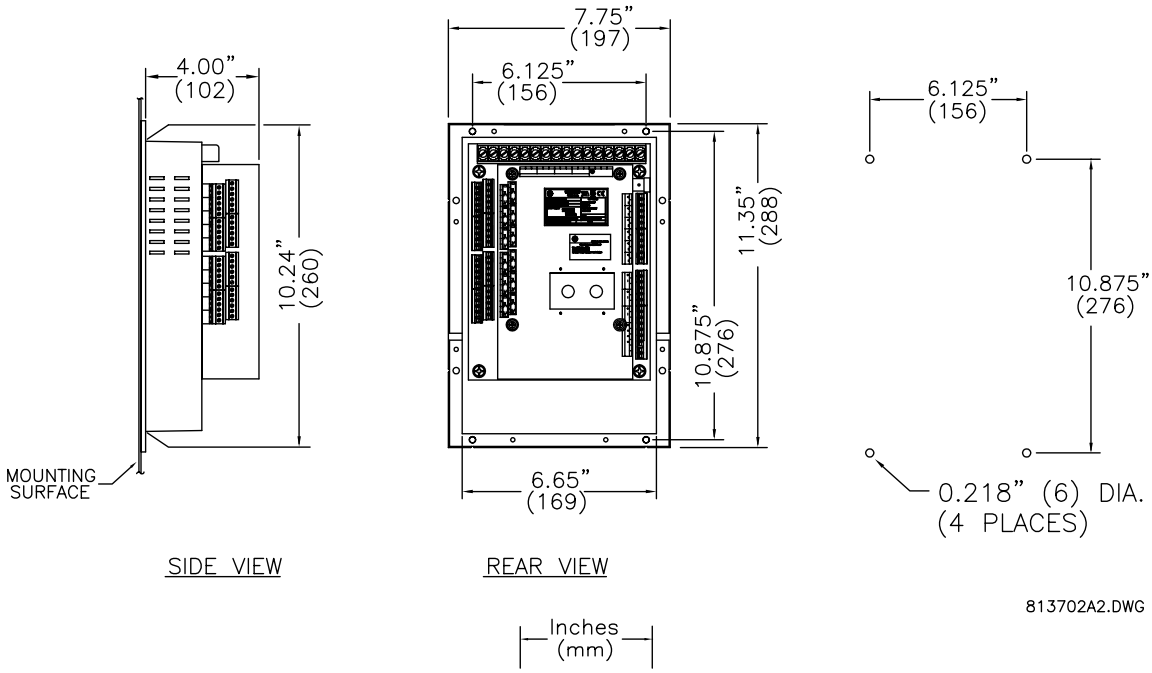


Figure 2–1: PHYSICAL DIMENSIONS

Table 2–1: TERMINAL LIST

TERMINAL	WIRING CONNECTION
1	RTD1 +
2	RTD1 –
3	RTD1 COMPENSATION
4	RTD1 SHIELD
5	RTD2 +
6	RTD2 –
7	RTD2 COMPENSATION
8	RTD2 SHIELD
9	RTD3 +
10	RTD3 –
11	RTD3 COMPENSATION
12	RTD3 SHIELD
13	RTD4 +
14	RTD4 –
15	RTD4 COMPENSATION
16	RTD4 SHIELD
17	RTD5 +
18	RTD5 –
19	RTD5 COMPENSATION
20	RTD5 SHIELD
21	RTD6 +
22	RTD6 –
23	RTD6 COMPENSATION
24	RTD6 SHIELD
25	RTD7 +
26	RTD7 –
27	RTD7 COMPENSATION
28	RTD7 SHIELD
29	RTD8 +
30	RTD8 –
31	RTD8 COMPENSATION
32	RTD8 SHIELD
33	RTD9 +
34	RTD9 –
35	RTD9 COMPENSATION
36	RTD9 SHIELD
37	RTD10 +
38	RTD10 –
39	RTD10 COMPENSATION
40	RTD10 SHIELD
41	RTD11 +
42	RTD11 –
43	RTD11 COMPENSATION
44	RTD11 SHIELD
45	RTD12 +
46	RTD12 –
47	RTD12 COMPENSATION
48	RTD12 SHIELD
51	DIGITAL INPUT 6
52	DIGITAL INPUT 6 COMMON
53	DIGITAL INPUT 5
54	DIGITAL INPUT 5 COMMON
55	DIGITAL INPUT 4
56	DIGITAL INPUT 4 COMMON
57	DIGITAL INPUT 3
58	DIGITAL INPUT 3 COMMON
59	DIGITAL INPUT 2
60	DIGITAL INPUT 2 COMMON
61	DIGITAL INPUT 1
62	DIGITAL INPUT 1 COMMON
71	COMM1 RS485 +
72	COMM1 RS485 –
73	COMM1 SHIELD
74	COMM2 RS485 +
75	COMM2 RS485 –
76	COMM2 SHIELD
77	COMM3 RS485 +
78	COMM3 RS485 –
79	COMM3 SHIELD
80	ANALOG OUT 1
81	ANALOG OUT 2
82	ANALOG OUT 3
83	ANALOG OUT 4
84	ANALOG COM
85	ANALOG SHIELD
111	TRIP NC
112	TRIP COMMON
113	TRIP NO
114	ALARM NC
115	ALARM COMMON
116	ALARM NO
117	AUX1 NC
118	AUX1 COMMON
119	AUX1 NO
120	AUX2 NC
121	AUX2 COMMON
122	AUX2 NO
123	POWER FILTER GROUND
124	POWER LINE
125	POWER NEUTRAL
126	POWER SAFETY

2.3.1 TYPICAL WIRING

Since the RRTD can cover a broad range of applications, wiring will be dependent upon the user's protection and monitoring scheme. This section covers most of the typical RRTD interconnections.

The terminals have been logically grouped together for explanation purposes. A typical wiring diagram for the RRTD is shown below. For further information on specific wiring applications, please refer to Chapter 7: APPLICATIONS or contact GE Multilin for further information.

WARNING

Hazard may result if the product is not used for intended purposes. This equipment can only be serviced by trained personnel.

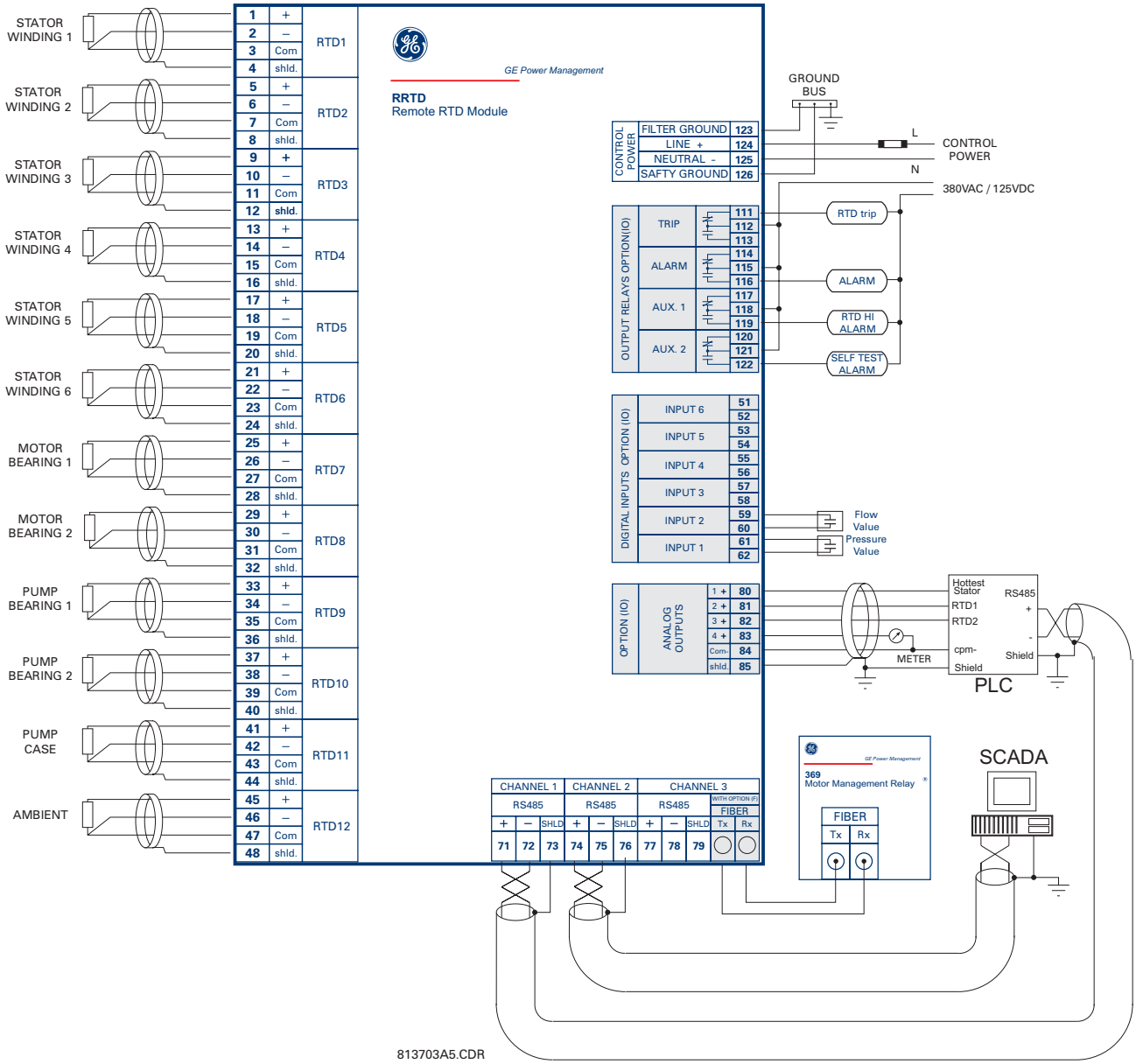


Figure 2–2: TYPICAL WIRING

2.3.2 CONTROL POWER

VERIFY THAT THE CONTROL POWER SUPPLIED TO THE RELAY IS WITHIN THE RANGE COVERED BY THE ORDERED RRTD RELAY'S CONTROL POWER.

CAUTION

Table 2–2: RRTD POWER SUPPLY RANGES

RRTD POWER SUPPLY	AC RANGE	DC RANGE
HI	40 to 265 V	50 to 300 V
LO	20 to 48 V	20 to 60 V

The RRTD power supply is a switchmode supply. It can operate with either AC or DC voltage applied to it.

Extensive filtering and transient protection has been incorporated into the RRTD to ensure reliable operation in harsh industrial environments. Transient energy is removed from the module and conducted to ground via the ground terminal. This terminal must be connected to the cubicle ground bus using a 10AWG wire or a ground braid. Do not daisy chain grounds with other devices. Each should have its own connection to the ground bus.

The internal supply is protected via a 3.15 A slo-blo fuse that is accessible for replacement. If it must be replaced ensure that it is replaced with a fuse of equal size (see Fuse Specifications in Technical Specifications - section 2)

2.3.3 RTD INPUTS

The RRTD can monitor up to 12 RTD inputs for Stator, Bearing, Ambient, or Other temperature applications. The type of each RTD is field programmable as: 100 Ω Platinum (DIN.43760), 100 Ω Nickel, 120 Ω Nickel, or 10 Ω Copper. RTDs must be the three wire type. There are no provisions for the connection of thermistors.

The RTD circuitry compensates for lead resistance, provided that each of the three leads is the same length. Lead resistance should not exceed 25 Ω per lead for platinum and nickel type RTDs or 3 Ω per lead for Copper type RTDs.

Shielded cable should be used to prevent noise pickup in industrial environments. RTD cables should be kept close to grounded metal casings and avoid areas of high electromagnetic or radio interference. RTD leads should not be run adjacent to or in the same conduit as high current carrying wires.

The shield connection terminal of the RTD is grounded in the RRTD and should not be connected to ground at the motor or anywhere else to prevent noise pickup from circulating currents.

If 10 Ω Copper RTDs are used, special care should be taken to keep the lead resistance as low as possible to maintain accurate readings.

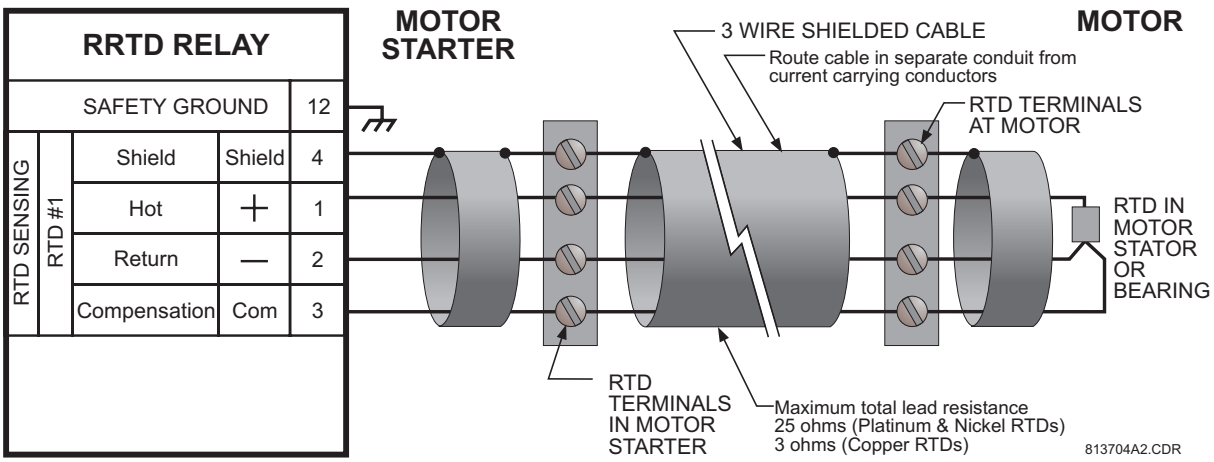


Figure 2–3: RTD INPUTS

2.3.4 DIGITAL INPUTS

DO NOT CONNECT LIVE CIRCUITS TO THE RRTD DIGITAL INPUTS. THEY ARE DESIGNED FOR DRY CONTACT CONNECTIONS ONLY.

The RRTD provides 6 programmable digital inputs with the Input/Output option (IO). They can also be programmed for use as generic inputs to set up trips and alarms or for monitoring purposes based on external contact inputs.

A twisted pair of wires should be used for digital input connections.

2.3.5 ANALOG OUTPUTS

The RRTD provides 4 analog current output channels with the Input/Output option (IO). These outputs are field programmable to a full-scale range of either 0 to 1 mA (into a maximum 2.4 kΩ impedance) and 4 to 20 or 0 to 20 mA (into a maximum 600 Ω impedance).

As shown in Figure 2–2: TYPICAL WIRING on page 2–3, these outputs share one common return. Polarity of these outputs must be observed for proper operation.

Shielded cable should be used for connections, with only one end of the shield grounded, to minimize noise effects. The analog output circuitry is isolated. Transorbs limit this isolation to ±36 V with respect to the RRTD safety ground.

If an analog voltage output is required, a burden resistor must be connected across the input of the SCADA or measuring device (see the figure below). Ignoring the input impedance of the input,

$$R_{LOAD} = \frac{V_{FULL\ SCALE}}{I_{MAX}}$$

For 0 to 1 mA, for example, if 5 V full scale is required to correspond to 1 mA,

$$R_{LOAD} = \frac{V_{FULL\ SCALE}}{I_{MAX}} = \frac{5\ \text{V}}{0.001\ \text{A}} = 5000\ \Omega$$

For 4 to 20 mA, this resistor would be

$$R_{LOAD} = \frac{V_{FULL\ SCALE}}{I_{MAX}} = \frac{5\ \text{V}}{0.020\ \text{A}} = 250\ \Omega$$

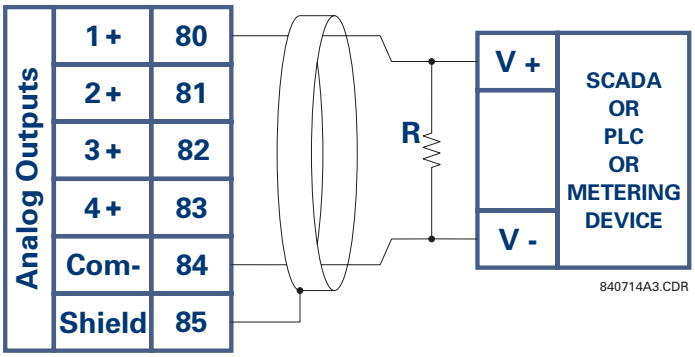


Figure 2–4: ANALOG OUTPUT VOLTAGE CONNECTION

2.3.6 DISPLAY

Monitoring and setting of the RRTD module can be performed via the 369 Motor Management Relay through a communication link to the RRTD. If a stand alone RRTD is required, a Quick Panel display can be configured to monitor actual values. The RTDPC program is used to program the module when it is configured as a stand alone.

2.3.7 OUTPUT RELAYS

The RRTD provides four form C output relays. They have been labeled Trip, Aux 1, Aux 2 and Alarm. Each relay has normally open (NO) and normally closed (NC) contacts and can switch up to 8 A at either 250 V AC or 30 V DC with a resistive load. The NO or NC state is determined by the 'no power' state of the relay outputs.

All four output relays may be programmed for fail-safe or non-fail-safe operation. When in fail-safe mode, output relay activation or a loss of control power will cause the contacts to go to their power down state.

For example:

- A *fail-safe NO contact* will close when the RRTD is powered up (if no prior unreset trip conditions) and will open when activated (tripped) or when the RRTD loses control power.
- A *non-fail-safe NO contact* will remain open when the RRTD is powered up (unless a prior unreset trip condition) and will close only when activated (tripped). If control power is lost while the output relay is activated (NO contacts closed) the NO contacts will open.

Thus, in order to cause a trip on loss of control power to the RRTD, the Trip relay should be programmed as fail-safe. See Figure 2–2: TYPICAL WIRING for typical wiring of contactors and breakers for fail-safe and non-fail-safe operation.

Output relays will remain latched after activation if the fault condition persists or the protection element has been programmed as latched. This means that once this relay has been activated it will remain in the active state until the RRTD is manually reset. The Trip relay cannot be reset if a timed lockout is in effect. Lockout time will be adhered to regardless of whether control power is present or not.

The relay contacts may be reset if motor conditions allow, by pressing the RESET key, using the REMOTE RESET switch or via communications. The Emergency Restart feature overrides *all* features to reset the RRTD.

NOTE

The rear of the RRTD relay shows output relay contacts in their power down state.

2.3.8 RS485 COMMUNICATIONS

Three independent two-wire RS485 ports are provided. If option (F), the fiber optic port, is installed and used the Comm 3 RS485 port, may not be used. The RS485 ports are isolated as a group.

Up to 32 devices can be daisy-chained together on a single serial communication channel without exceeding the driver capability. For larger systems, additional serial channels must be added. Commercially available repeaters may also be used to increase the number of relays on a single channel to a maximum of 254. Note that there may only be one master device per serial communication link.

Connections should be made using shielded twisted pair cables (typically 24AWG). Suitable cables should have a characteristic impedance of 120 Ω (e.g. Belden #9841) and total wire length should not exceed 4000 feet. Commercially available repeaters can be used to extend transmission distances.

Voltage differences between remote ends of the communication link are not uncommon. For this reason, surge protection devices are internally installed across all RS485 terminals. Internally, an isolated power supply with an optocoupled data interface is used to prevent noise coupling. The source computer/PLC/SCADA system should have similar transient protection devices installed, either internally or externally, to ensure maximum reliability.

CAUTION

To ensure that all devices in a daisy-chain are at the same potential, it is imperative that the common terminals of each RS485 port are tied together and grounded in <u>one location</u> only, at the master. Failure to do so may result in intermittent or failed communications.

Correct polarity is also essential. RRTDs must be wired with all positive (+) terminals connected together and all negative (–) terminals connected together. Each relay must be daisy-chained to the next one. Avoid star or stub connected configurations. The last device at each end of the daisy chain should be terminated with a 120 Ω 1/4 W resistor in series with a 1nF capacitor across the '+' and '–' terminals. Observing these guidelines will result in a reliable communication system that is immune to system transients.

3.1.1 REQUIREMENTS

The following minimum requirements must be met for the RTDPC software to operate properly.

Processor: Minimum 486, Pentium or higher recommended.

Memory: Minimum 4 MB RAM, 16 MB recommended. Minimum 540 K of conventional memory.

Hard Drive: 20 MB free space required before installation of software.

O/S: Minimum Windows 3.1/3.11, Windows NT, or Windows 95/98 (recommended).
Windows 3.1 Users must ensure that **SHARE.EXE** is installed.

Other: CD-ROM or internet capability to install RTDPC
(if neither is available, 3.5" floppy disks can be ordered from the factory)

If RTDPC is currently installed, note the path and directory name. This information is required when upgrading.

The RTDPC software is included on the GE Multilin Products CD included with the RRTD. If your PC does not have CD-ROM capability, the software may be downloaded from the GE Multilin website at www.GEindustrial.com/multilin or ordered on 3.5" floppy disks from the nearest GE Multilin office.

NOTE

All products include the GE Multilin Products CD. Since this CD is essentially a “snapshot” of the GE Multilin website, the procedures for installation from the CD and the Web are identical. However, the website will always contain the newest versions and is recommended for upgrading the software.

3.1.2 INSTALLING RTDPC

Installation of the RTDPC software is accomplished as follows.

1. Ensure that Windows is running and functional on the local PC
2. Insert the GE Multilin Products CD into your CD-ROM drive ***or*** point your web browser to the GE Multilin website at www.GEindustrial.com/multilin. With Windows 95/98, the Products CD will launch the welcome screen automatically (alternately, you may open the `index.htm` file in the Products CD root directory). Since the Products CD is essentially a “snapshot” of the GE Multilin website, the procedures for installation from the CD and the Web are identical from this point forward.
3. Click the **Index By Product Name** item from the main page menu and select the RRTD Remote RTD Module from the product list to open the RRTD product page.
4. Click the **Software** menu item from the Product Resources list to proceed to the RRTD software page.
5. The latest version of the RTDPC software will be shown. Select the **RTDPC Program** item to download the installation program to your local PC. Run the installation program and follow the prompts to install the software to the desired directory. When complete, a new GE Multilin group window will appear containing the RTDPC icon.

3.1.3 UPGRADING RTDPC

The following procedure determines if the currently installed version of RTDPC requires upgrading:

1. Run the RTDPC software.
2. Select the **Help > About RTDPC** menu item.
3. Compare the version shown in this window with the version on the Products CD or website. If the installed version is lower than the version on the CD or web, then RTDPC needs to be upgraded.
4. To upgrade the RTDPC software, follow the installation instructions shown in the previous section. The installation program will automatically upgrade the RTDPC software.

3.2.1 CONFIGURATION

1. Connect the computer containing the RTDPC software to the relay via the Channel 1 or 2 RS485 port. Channel 3 is designated for communication to the 369 relay for remote RTD monitoring and is not meant for use with the RTDPC software.
2. Run the RTDPC software. Once the program starts to operate, it will not automatically communicate with the relay unless enabled to do so (see the **Startup Mode** option below). The LED status and display message shown will match actual relay state if communications is established.
3. To setup communications, select **Communication > Computer** menu item.

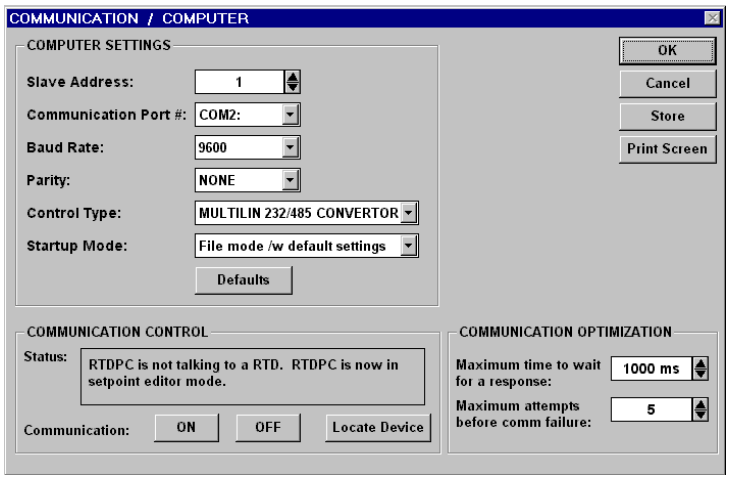
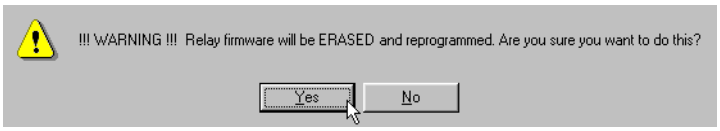


Figure 3–1: COMMUNICATION / COMPUTER WINDOW

4. Set **Slave Address** to match that programmed into relay.
5. Set **Communication Port#** to the computer port connected to the relay.
6. Set **Baud Rate** and **Parity** to match that programmed into relay.
7. Set **Control Type** to type used.
8. Set **Startup Mode** to the desired startup (communicate or file)
9. Select **ON** to enable communications with new settings.

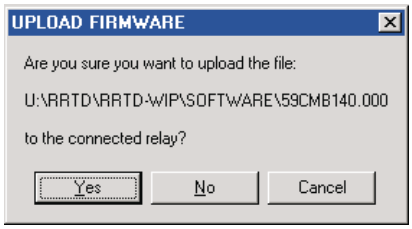
3.2.2 UPGRADING FIRMWARE

1. To upgrade the relay firmware, connect a computer to the Channel 1 RS485 Port of the RRTD. Channels 2 and 3 cannot be used to upgrade the relay firmware.
2. Run RTDPC and establish communications with the relay.
3. Select the **Communication > Upgrade Firmware** menu item. The following window will appear:



4. Select **Yes** to proceed or **No** to abort. Remember, all previously programmed setpoints will be erased! If you have not already created a setpoint file, it is highly recommended that the current setpoints be saved to disk by following the procedure in Section 3.2.3: CREATING A NEW SETPOINT FILE on page 3–3 before continuing with the firmware upgrade.
5. The Load Firmware window will appear. Locate the firmware file to load into the relay and select **OK** to proceed or **Cancel** to quit the firmware upgrade.

6. The Upload Firmware dialog box shown below will appear. This provides one last chance to cancel the firmware upgrade. Select **Yes** to proceed, **No** to load a different firmware file, or **Cancel** to end the firmware upgrade. This will be the last chance to cancel the firmware upgrade – all previously programmed setpoints will be erased!



7. The RTDPC software automatically puts the relay into upload mode and then begin loading the file selected.
8. When loading is complete, the relay will require programming. To reload the previously programmed setpoints, see the procedure in Section 3.2.5: DOWNLOADING A SETPOINT FILE on page 3–4.

3.2.3 CREATING A NEW SETPOINT FILE

1. To create a new setpoint file, run RTDPC. It is not necessary to have an RRTD unit connected to the computer to create the file; however, some setpoint sections are only active if there is communication with an RRTD. The RTDPC status bar will indicate that the program is in “Editing File” mode and “Not Communicating”.
2. From the **Setpoint** menu, choose the appropriate setpoints section to program, for example, **S3 RTD Temperature > RTD Protection** to enter output relay setup setpoints.

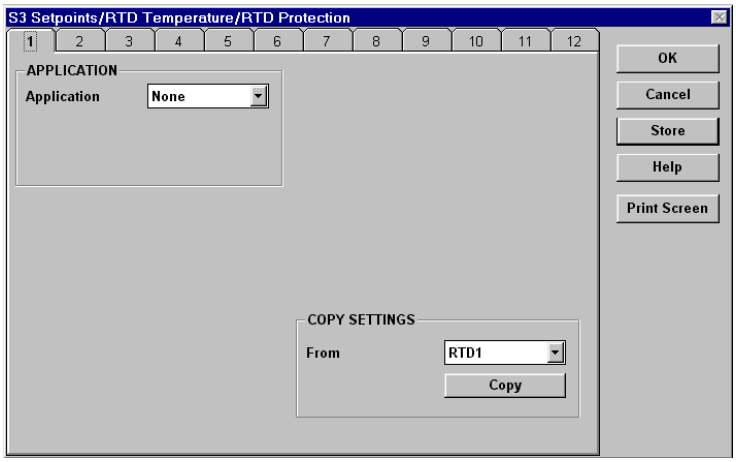


Figure 3–2: RTD PROTECTION WINDOW

3. When you are finished programming a page, select **OK** to store the information to the RTDPC scratchpad memory (note: this action does not store the information as a file on a disk).
4. Repeat steps 2 to 3 until all the desired setpoints are programmed.
5. Select the **File > Save As** menu item to store these setpoints to the disk. Enter the location and file name of the setpoint file with a file extension of ‘.RTD’ and select **OK**.
6. The file is now saved. See Section 3.2.5: DOWNLOADING A SETPOINT FILE on page 3–4 for instructions on reloading this file to the RRTD.

3.2.4 EDITING A SETPOINT FILE

The following procedure describes how to edit setpoint files.

1. Run the RTDPC software. It is not necessary to have an RRTD unit connected to the computer. The status bar will indicate that the program is in “Polling Relay” mode and “Not Communicating”.
2. If the RTDPC is communicating, select the **Communication > Computer** menu item to launch the COMMUNICATION/COMPUTER window (see Figure 3–1: COMMUNICATION / COMPUTER WINDOW on page 3–2) and set **Communicate** to "Off". Click **OK** to turn off communications to the relay and place RTDPC in “Editing File” mode.
3. Open a setpoint file by selecting the **File > Open** menu item. Locate the appropriate RRTD setpoint files (ending with the extension ’.RTD’) and select **OK**.
4. From the Setpoints menu item, choose the appropriate setpoints section to program; for example, **System Setup > Output Relay Setup** to edit the output relay setup setpoints. When you have finished editing a page, select **OK** to store the information to the RRTD scratchpad memory (NOTE: this action does not store the information as a file on a disk).
5. Repeat Step 4 until all the desired setpoints are edited. Select the **File > Save As** menu item to store this file to disk. Enter the location and file name of the setpoint file with a file extension of ‘.RTD’.
6. The file is now saved to disk. See Section 3.2.5: DOWNLOADING A SETPOINT FILE on page 3–4 for instructions on downloading this file to the RRTD.

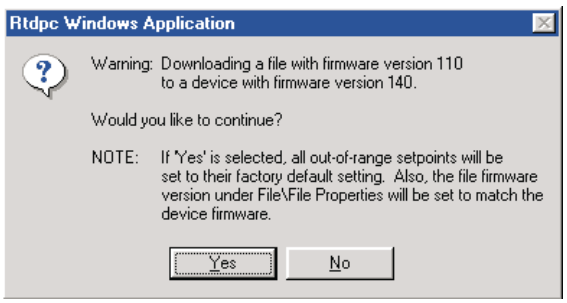
3.2.5 DOWNLOADING A SETPOINT FILE

The following procedure describes how to download setpoint files to the RRTD.

1. To download a pre-programmed setpoint file to the RRTD, run RTDPC and establish communications with the connected relay via the RS485 connector.
2. Select the **File > Open** menu item to locate the setpoint file to be loaded into the relay. Click **OK** to load.
3. When the file is completely loaded, the RTDPC software will break communications with the connected relay and the status bar changes to indicate “Editing File”, “Not Communicating”.
4. Select the **File > Send Info To Relay** menu item to download the setpoint file to the connected relay.
5. When the file is completely downloaded, the status bar will revert back to “Communicating”. The RRTD now contains all the setpoints as programmed in the setpoint file.

NOTE

If an attempt is made to download a setpoint file with a revision number that does not match the relay firmware revision, the following message type will appear:



See Section 3.2.6: UPGRADING SETPOINT FILE TO NEW REVISION on page 3–5 for instructions on upgrading the setpoint file.

3.2.6 UPGRADING SETPOINT FILE TO NEW REVISION

The following procedure describes how to upgrade setpoint file revisions. It may be necessary to upgrade the revision code for a previously saved setpoint file when the RRTD firmware is upgraded.

1. To upgrade the revision of a previously saved setpoint file, run the 369PC software and establish communications with the RRTD through the RS485 connector.
2. Select the **Actual > A5 Relay Information** menu item and record the **Main Software** revision number (for example, 59CMB115.000, where 115 is the main revision identifier and refers to firmware version 1.15).

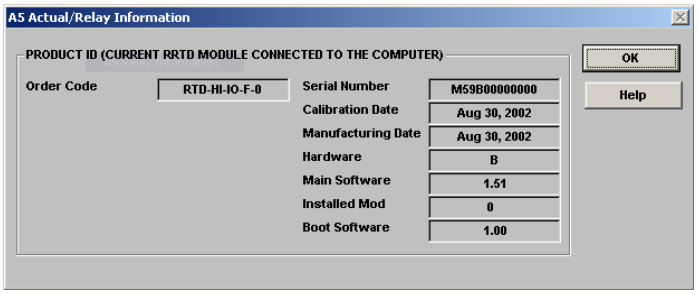


Figure 3–3: RELAY INFORMATION WINDOW

3. Select the **File > Open** menu item and select the setpoint file to be downloaded to the connected relay. When the file is open, the RTDPC software will be in "File Editing" mode and "Not Communicating".
4. Select the **File > Properties** menu item and note the version code of the setpoint file.

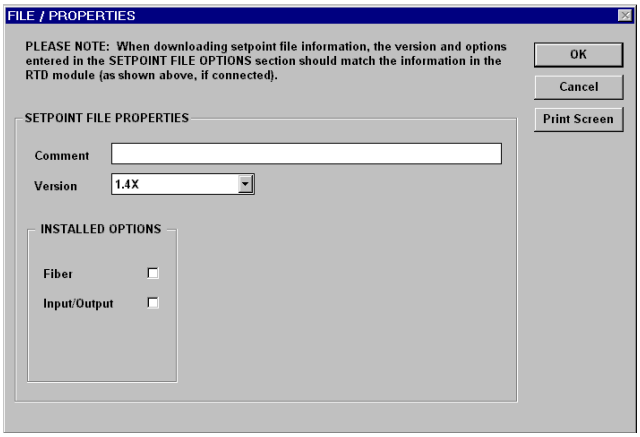


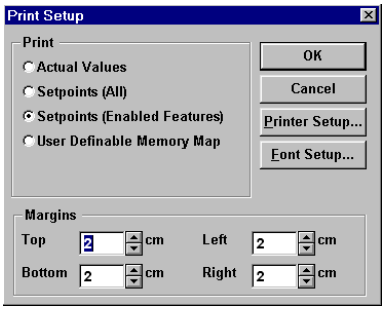
Figure 3–4: SETPOINT FILE PROPERTIES

5. If the **Version** code (e.g. 1.4X above) differs the firmware revision (noted in step 2 as 115), select the revision code that matches the firmware from the pull-down tab. For example: for firmware revision 59CMB140.000 and current setpoint revision as 1.15; change the **Version** code to 1.4X to upgrade.
6. Select the **File > Save** menu item to save the setpoint file.
7. To download the upgraded setpoint file to the RRTD, see Section 3.2.5: DOWNLOADING A SETPOINT FILE on page 3–4.

3.2.7 PRINTING

This procedure describes how to print a list of the RRTD setpoints and/or actual values.

1. Start RTDPC. It is not necessary to establish communications.
2. Select the **File > Open** menu item to open a previously saved setpoint file, *or* establish communications with a connected RRTD unit.
3. Select the **File > Print Setup** menu item. The following window will appear.



- Select Actual Values to print a list of actual values.
- Select Setpoints (All) or Setpoints (Enabled Features) to print a list of setpoints.
- Select User Definable Memory Map to print the user-definable memory map.

4. Click **OK** to close the Window.
5. Select the **File > Print** menu item to send the setpoint/actual values file to the connected printer.

3.2.8 TROUBLESHOOTING

This section provides some tips for troubleshooting RTDPC when troubles are encountered within the Windows environment, e.g. **General Protection Fault (GPF), Missing Window, Problems in Opening/Saving Files, and Application Error**.

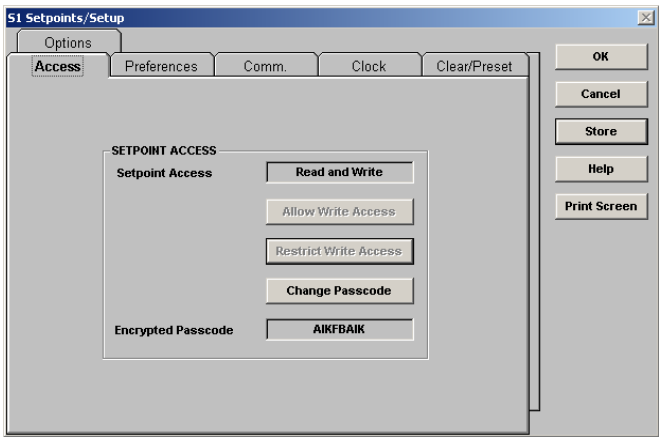
If the RRTD program causes Windows system errors:

- Ensure the RTDPC software is correctly installed and the PC being used meets the minimum requirements.
- Ensure that only one copy of RTDPC is running at a given time: the RTDPC software cannot multi-task.

4.1.1 SETPOINT ACCESS

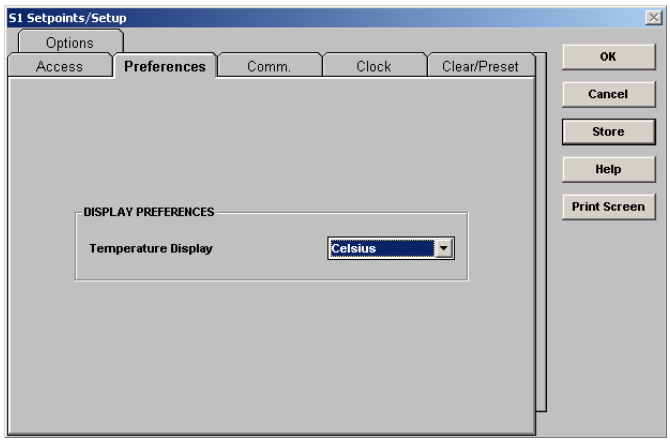
The communication access may be changed through the RTDPC software. Setpoint access is changed in the **Setpoint > S1 Setup** menu item. An access tab is shown only when communicating with a relay. To set a passcode, click the **Change Passcode** button. Enter and verify a new passcode; after a passcode is entered, the **Setpoint Access** changes to "Read Only". When setpoints are changed through the PC program during Read Only access, the user is prompted to enter the passcode before the new setpoint is stored. To allow extended write access, click on **Allow Write Access** and enter the passcode. To change the access level back to "Read Only", click **Restrict Write Access**. If 30 minutes elapses without setpoint changes, or if control power is cycled, access automatically reverts to "Read Only".

If the access level is "Read and Write", write access to setpoints is automatic and a 0 passcode need not be entered. If the programmed passcode is not known, consult the factory service department with the **Encrypted Passcode** to be decoded.



4.1.2 PREFERENCES

The Preferences section of the **Setpoint > S1 Setup** menu item allows the user to set the temperature display units to either Celsius or Fahrenheit. The value chosen here will be reflected in all temperature actual values. RTD setpoints are programmed in Celsius only.



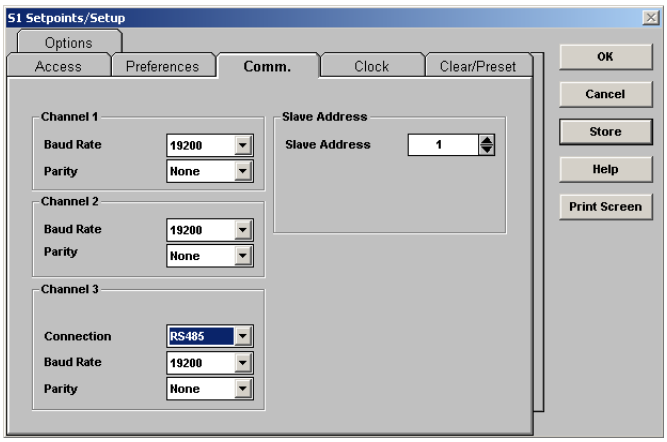
4.1.3 RRTD COMMUNICATIONS

The RRTD is equipped with three independent RS485 serial ports. The RRTD can act as a stand-alone unit or can be connected along with a maximum of three (3) other RRTDs to the 369 Motor Management Relay. **In this case, Channel 3 must be used for communication between the devices (see Section 6.1.4: MONITORING OF UP TO 60 RTDs on page 6–3 for additional details).** Communications Channels 1 and 2 may be used by other devices (for example, computers or PLCs). **Only Channel 1 may be used to upgrade firmware on the RRTD**.

The **CHANNEL 3 APPLICATION** setpoint of the 369 must be set to "RRTD" and each Remote RTD must have its application set to "Modbus" and assigned a unique address. **Each RRTD slave address must be set prior to connecting it to the network**. Establish communication with only one RRTD by using the default slave address of 254. Then change the Slave Address in the **S1 Setpoints > Setup** window. When this new Slave Address is stored, the RRTD will lose communications with RTDPC. At this point, the new address must then be stored in Communications Setup and communications re-established with the relay.

Option F, a fiber optic port, may be ordered and used for Channel 3 communications. If the Channel 3 fiber optic port is used, the Channel 3 RS485 connection is disabled.

RS485 communications support a subset of RTU protocol. Each must have a unique address from 1 to 254. Address 0 is the broadcast address which all relays listen to. Addresses do not have to be sequential but no two devices can have the same address or conflicts resulting in errors will occur. Generally each added to the link will use the next higher address starting at 1. A maximum of 32 devices can be daisy chained and connected to a DCS, PLC or PC using the RS485 ports. A repeater may be used to increase the number of relays on a single link to greater than 32.

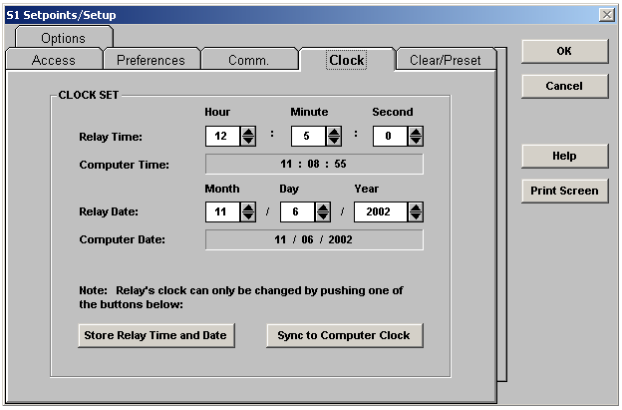


4.1.4 REAL TIME CLOCK

The time/date stamp is used to track events for diagnostic purposes. The date and time are preset but may be entered manually. A battery allows the internal clock to run continuously even when power is off. It has the same accuracy as an electronic watch, approximately ±1 minute per month. It may be periodically corrected via the clock update command over the serial link using the PC program.

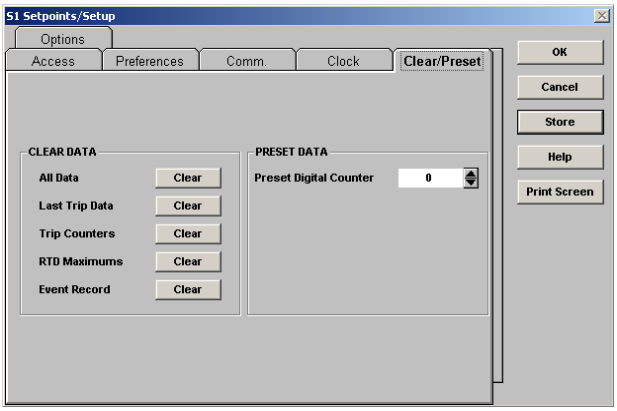
Enter the current date using two digits for the month, two digits for the day, and four digits for the year. For example, July 15, 2001 would be entered as "07 15 2001". If entered from the keypad, the new date will take effect the moment the [Store Relay Time and Date] button is clicked. Enter the current time, by using two digits for the hour in 24 hour time, two digits for the minutes, and two digits for the seconds. If entered from the keypad, the new time will take effect the moment the [Store Relay Time and Date] button is clicked.

If the serial communication link is used, then all the relays can keep time in synchronization with each other. A new clock time is pre-loaded into the memory map via the communications port by a remote computer to each relay connected on the communications channel. The computer broadcasts (address 0) a “set clock” command to all relays. Then all relays in the system begin timing at the exact same instant. There can be up to 100 ms of delay in receiving serial commands so the clock time in each relay is ±100 ms, ± the absolute clock accuracy in the PLC or PC (see Chapter 8: COMMUNICATIONS for information on programming the time and synchronizing commands).



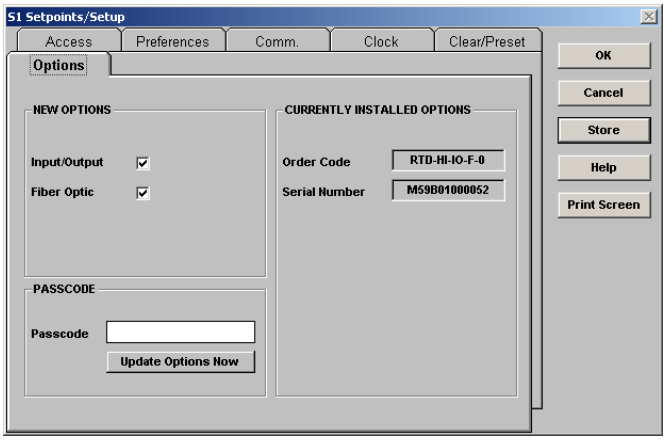
4.1.5 CLEAR/PRESET DATA

These commands may be used to clear various historical data. This is useful on new installations or to preset information on existing installations where new equipment has been installed. The PRESET DIGITAL COUNTER message will only be seen if one of the digital inputs has been configured as a digital input counter.



4.1.6 OPTIONS

The currently installed RRTD options, order code, and serial number are displayed in this window. If new options are installed after ordering, select the relevant option ("Input/Output" and/or "Fiber Optic"), enter the passcode, and click the **Update Options Now** button to update the RTDPC software to recognize them.

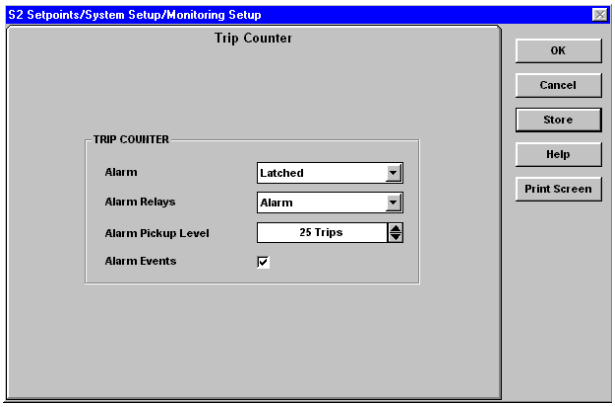


4.2.1 DESCRIPTION

These setpoints are critical to the operation of the RRTD protective elements and control features. The output relay setup and Control Functions are not shown if the IO option is not installed.

4.2.2 MONITORING SETUP

When the Trip Counter is enabled and the alarm pickup level is reached, an alarm will occur. To reset the alarm, the trip counter must be cleared (see Section 4.1.5: CLEAR/PRESET DATA on page 4–3) or the pickup level increased and a reset command issued. The trip counter alarm can be used to monitor and alarm when a predefined number of trips occur. This would then prompt the operator or supervisor to investigate the causes of the trips that have occurred. See Section 5.3.1: TRIP COUNTERS on page 5–4 for details of the individual trip counters.

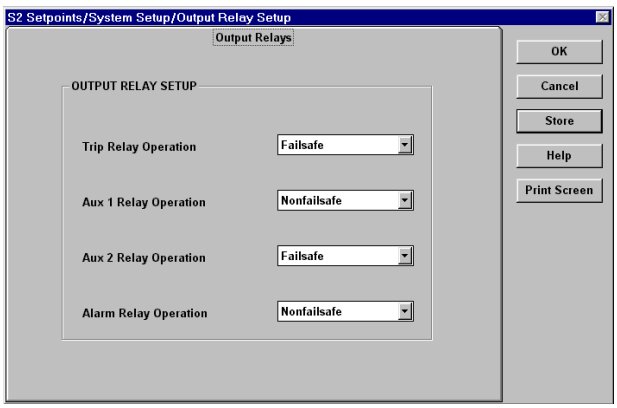


4.2.3 OUTPUT RELAY SETUP

A latched relay (caused by a protective elements alarm or trip) may be reset at any time, providing that the condition that caused operation is no longer present. Unlatched elements automatically reset when the condition has cleared.

These setpoints allow the relay output operation to be fail-safe or non-failsafe. The latchcode however, is defined individually for each protective element. Failsafe operation causes the output relay to energize in its normal state and de-energize when activated by a protection element. A failsafe relay also changes state (if not already activated by a protection element) when control power is removed from the RRTD. Conversely a non-failsafe relay de-energizes in its normal non-activated state and does not change state when control power is removed (if not already activated by a protection element).

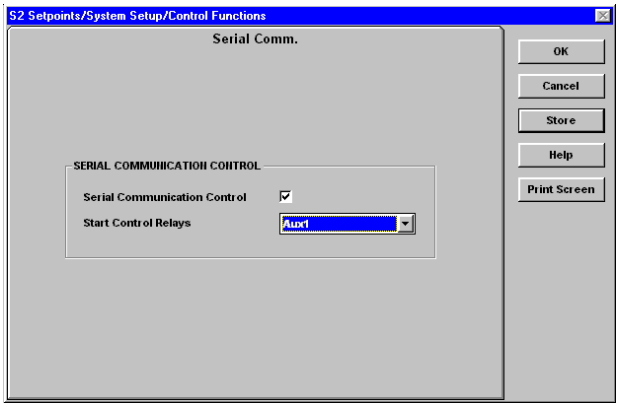
The choice of failsafe or non-failsafe operation is usually determined by the application. In situations where the process is more critical than the protected equipment, non-failsafe operation is typically programmed. In situations where the equipment is more critical than the process, failsafe operation is programmed.



4.2.4 CONTROL FUNCTIONS

If enabled the motor may be remotely started and stopped via Modbus communications to the RRTD. Refer to Section 8.2.8: FUNCTION CODE 16: PERFORMING COMMANDS on page 8–7 for details on how to send commands. When a Stop command is sent the Trip relay will activate for 1 second to complete the trip coil circuit for a breaker application or break the coil circuit for a contactor application. When a Start command is issued the relay assigned for starting control will activate for 1 second to complete the close coil circuit for a breaker application or complete the coil circuit for a contactor application.

The Serial Communication Control functions may also be used to reset the unit. Refer to 8.2.3: FUNCTION CODE 05: EXECUTE OPERATION on page 8–4 for more information.



4.3.1 DESCRIPTION

These setpoints deal with the RTD overtemperature elements of the RRTD.

4.3.2 LOCAL RTD PROTECTION

- **Application**: Each individual RTD may be assigned an application. A setting of None effectively turns that individual RTD off. Only RTDs with the application set to Stator are used for RTD biasing of the thermal model.
- **Type**: Each RTD is individually assigned the RTD type connected to it. Multiple types may be used with a single RRTD.
- **Name**: Each RTD may be assigned an 8 character (maximum) name. This name is used in alarm and trip messages.
- **Alarm/Hi Alarm/Trip**: Each RTD can be programmed for separate Alarm, Hi Alarm and Trip levels and relays. Trips are automatically stored as events. Alarms and Hi Alarms are stored as events only if the Record Alarms as Events setpoint for that RTD is set to Yes.
- **Trip Voting**: This feature has been included for added RTD trip reliability in situations where RTD malfunction and nuisance tripping is common. If enabled that RTD will only trip if the RTD or RTDs listed to be voted with are also above their trip level. For example, if RTD 1 is set to vote with All Stator RTDs, the RRTD will only trip if RTD 1 is above its trip level and any one of the other stator RTDs is also above its own trip level. RTD voting is typically only used on Stator RTDs and typically done between adjacent RTDs to detect hot spots.

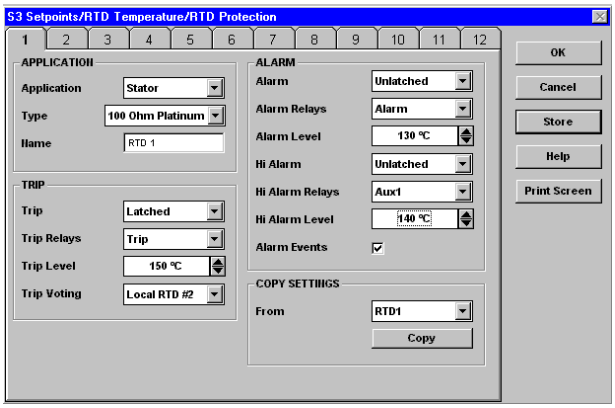
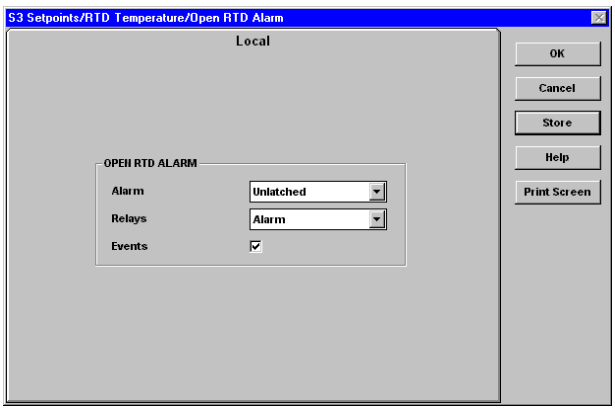


Table 4–1: RTD RESISTANCE TO TEMPERATURE

TEMPERATURE		RTD RESISTANCE (IN OHMS)			
°C	°F	100 Ω Pt (DIN43760)	120 Ω Ni	100 Ω Ni	10 Ω Cu
–40	–40	84.27	92.76	79.13	7.49
–30	–22	88.22	99.41	84.15	7.88
–20	–4	92.16	106.15	89.23	8.26
–10	14	96.09	113.00	94.58	8.65
0	32	100.00	120.00	100.0	9.04
10	50	103.90	127.17	105.6	9.42
20	68	107.79	134.52	111.2	9.81
30	86	111.67	142.06	117.1	10.19
40	104	115.54	149.79	123.0	10.58
50	122	119.39	157.74	129.1	10.97
60	140	123.24	165.90	135.3	11.35
70	158	127.07	174.25	141.7	11.74
80	176	130.89	182.84	148.3	12.12
90	194	134.70	191.64	154.9	12.51
100	212	138.50	200.64	161.8	12.90
110	230	142.29	209.85	168.8	13.28
120	248	146.06	219.29	176.0	13.67
130	266	149.82	228.96	183.3	14.06
140	284	153.58	238.85	190.9	14.44
150	302	157.32	248.95	198.7	14.83
160	320	161.04	259.30	206.6	15.22
170	338	164.76	269.91	214.8	15.61
180	356	168.47	280.77	223.2	16.00
190	374	172.46	291.96	231.6	16.39
200	392	175.84	303.46	240.0	16.78

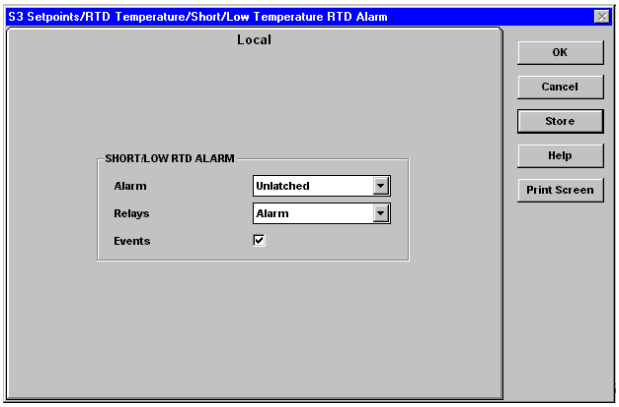
4.3.3 OPEN RTD ALARM

The RRTD has an Open RTD Sensor Alarm. This alarm will look at all RTDs that have been assigned an application other than 'None' and determine if an RTD connection has been broken. When a broken sensor is detected, the assigned output relay will operate and the RTDPC program will identify the RTD that is broken. It is recommended that if this feature is used, the alarm be programmed as latched so that intermittent RTDs are detected and corrective action may be taken.



4.3.4 SHORT/LOW TEMP RTD ALARM

The RRTD has an RTD Short/Low Temperature alarm. This alarm will look at all RTDs that have an application other than 'None' and determine if an RTD has either a short or a very low temperature (less than –40°C). When a short/low temperature is detected, the assigned output relay will operate and a message will appear on the display identifying the RTD that caused the alarm. It is recommended that if this feature is used, the alarm be programmed as latched so that intermittent RTDs are detected and corrective action may be taken.

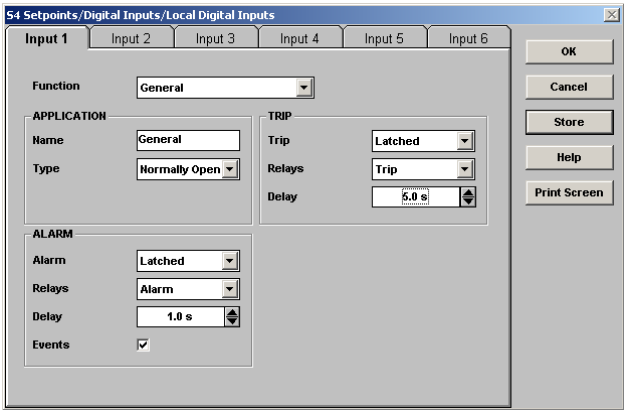


4.4.1 DIGITAL INPUT FUNCTIONS

Any of the programmable digital inputs may be programmed as a General Switch Input or Digital Counter.

NOTE

Digital input alarms and trips (both General or Digital Counter) are activated at the local module, the master's output relays DO NOT activate.



Only one digital input may be selected as a digital counter at a time. User defined units and counter name may be defined and these will appear on all counter related actual value and alarm messages. To clear a digital counter alarm, the alarm level must be increased or the counter must be cleared or preset to a lower value.

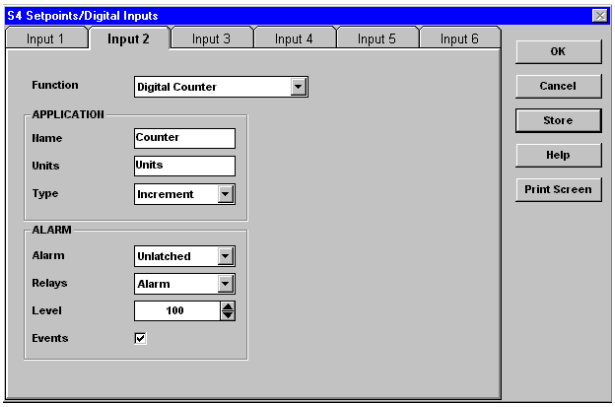
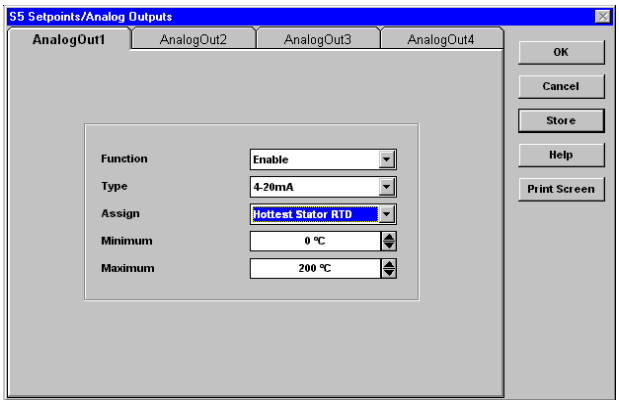


Table 4–2: ANALOG OUTPUT PARAMETERS

PARAMETER NAME	RANGE /UNITS	STEP	DEFAULT	
			MINIMUM	MAXIMUM
Hottest Stator RTD	–40 to +200°C or –40 to +392°F	1	0	200
RTD #1 to 12	–40 to +200°C or –40 to +392°F	1	–40	200

NOTE

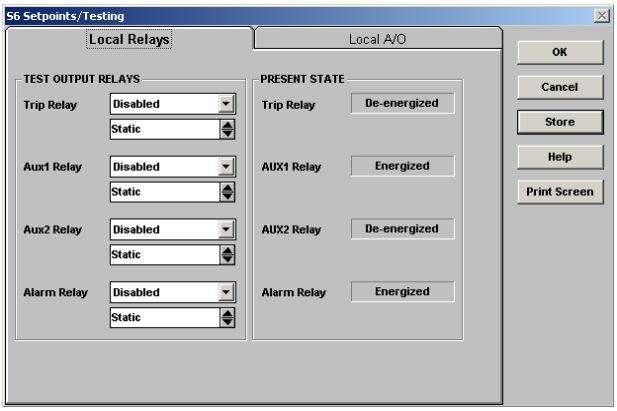
The analog outputs are only configurable for the local RTDs.



4.6.1 FORCE OUTPUT RELAYS

The Force Output Relay feature provides a method of performing checks on all relay contact outputs. The feature can also be used for control purposes while the equipment is operating. The forced state **overrides** the normal operation of the relay output.

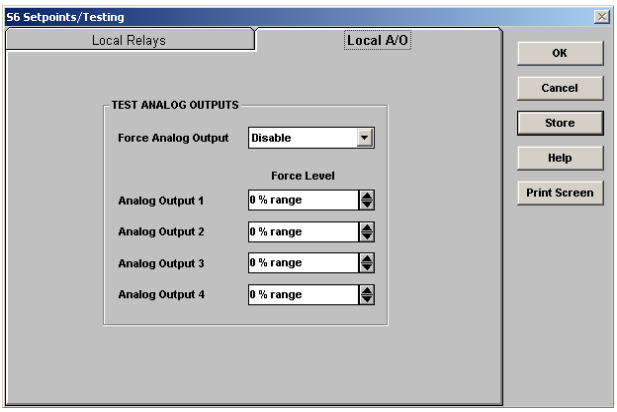
The forced state, if enabled (energized or de-energized), will force the selected relay into the programmed state for as long as the programmed duration. After the programmed duration expires the forced state will return to disabled and relay operation will return to normal. If the duration is programmed as Static, the forced state will remain in effect until changed or disabled. If control power to the RRTD is interrupted, any forced relay condition will be removed.



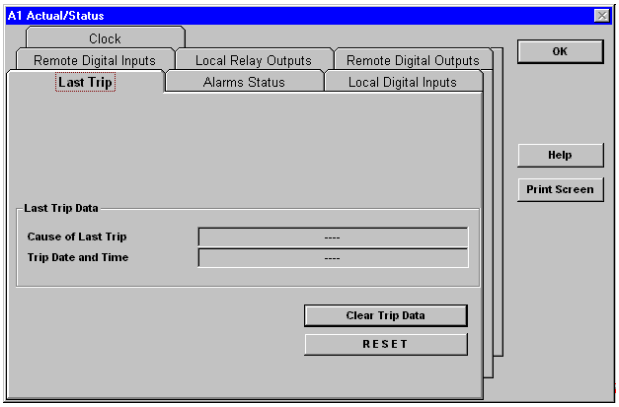
4.6.2 FORCE ANALOG OUTPUTS

The Force Analog Output setpoints may be used during startup or testing to verify that the analog outputs are functioning correctly. It may also be used when the motor is running to give manual or communication control of an analog output. Forcing an analog output **overrides** its normal functionality.

When the Force Analog Outputs Function is enabled, the output will reflect the forced value as a percentage of the range 4 to 20 mA, 0 to 20 mA, or 0 to 1 mA. Selecting Off will place the analog output channels back in service, reflecting the parameters programmed to each.



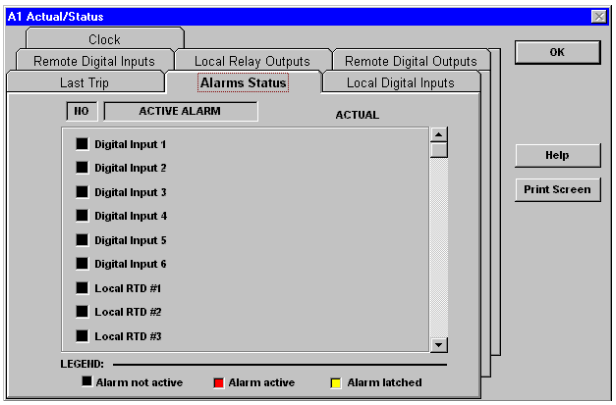
5.1.1 LAST TRIP DATA



Immediately prior to a trip, the RRTD records the cause of trip, the date and time and stores this as pre-trip value. This allows for ease of troubleshooting when a trip occurs. These values are overwritten when the next trip occurs.

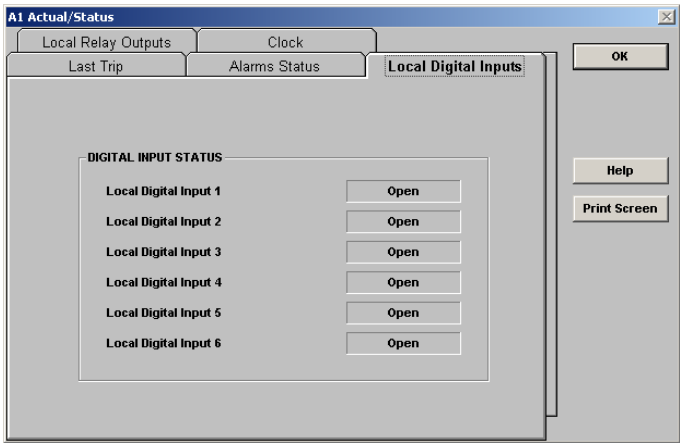
The resetting of any latched trip or alarm is done here. All RTD trips and alarms are activated at the master only; thus any latched RTD trip or alarm is resettable at the master by clicking on the Reset button. On the other hand, digital trips or alarms are activated at the slave only; thus any latched digital trip or alarm is resettable by clicking on the related RRTD reset button.

5.1.2 ALARM STATUS



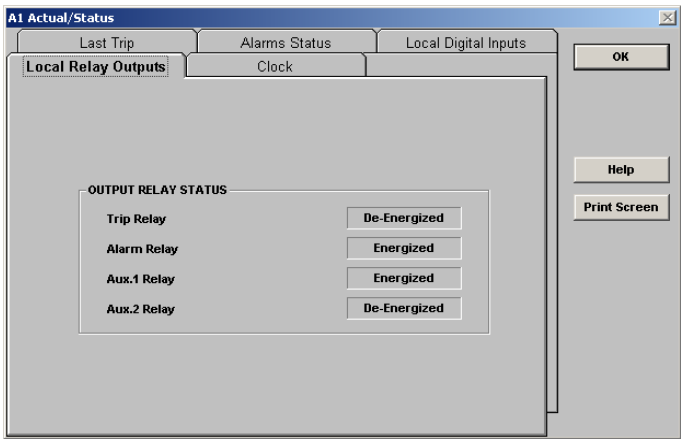
Any active alarm may be viewed here. If the Line Up and Down keys are not pressed, the active messages will automatically cycle. The current level causing the alarm is displayed along with the alarm name.

5.1.3 DIGITAL INPUT STATUS



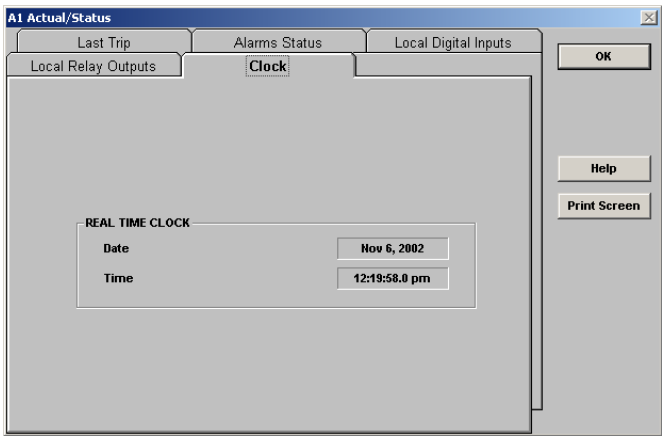
The present state of the digital inputs will be displayed here.

5.1.4 OUTPUT RELAY STATUS



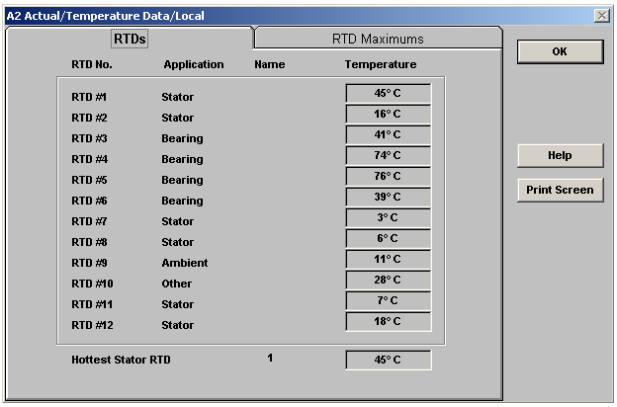
The present state of the output relays will be displayed here. Energized indicates that the NO contacts are now closed and the NC contacts are now open. De-energized indicates that the NO contacts are now open and the NC contacts are now closed. Forced indicates that the output relay has been commanded into a certain state.

5.1.5 REAL TIME CLOCK



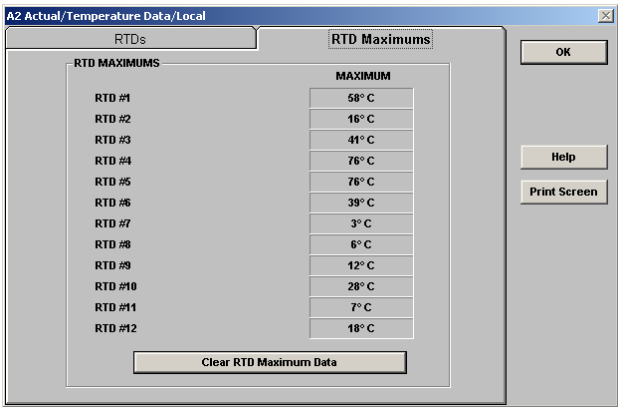
The date and time from the RRTD real time clock may be viewed here.

5.2.1 LOCAL RTD



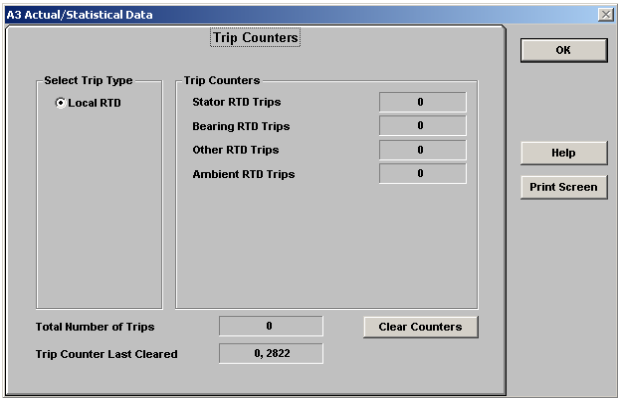
- **LOCAL RTD**: The temperature level of all 12 internal RTDs will be displayed here. The programmed name of each RTD (if changed from the default) will appear as the first line of each message.

5.2.2 LOCAL RTD MAXIMUMS



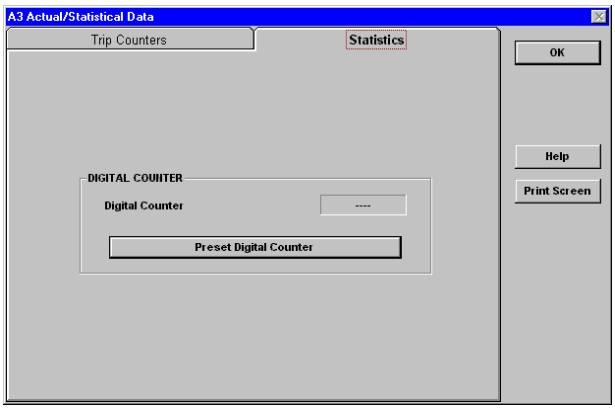
- **LOCAL RTD MAXIMUMS**: The maximum temperature level of all 12 internal RTDs will be displayed. The programmed name of each RTD (if changed from the default) will appear as the first line of each message.

5.3.1 TRIP COUNTERS



A breakdown of the number of trips by type is displayed here. When the total reaches 50000, the counter resets to 0 on the next trip and continues counting. This information can be cleared in the **Setpoints > S1 Setup** menu item (see Clear/Preset tab). The date the counters are cleared is recorded.

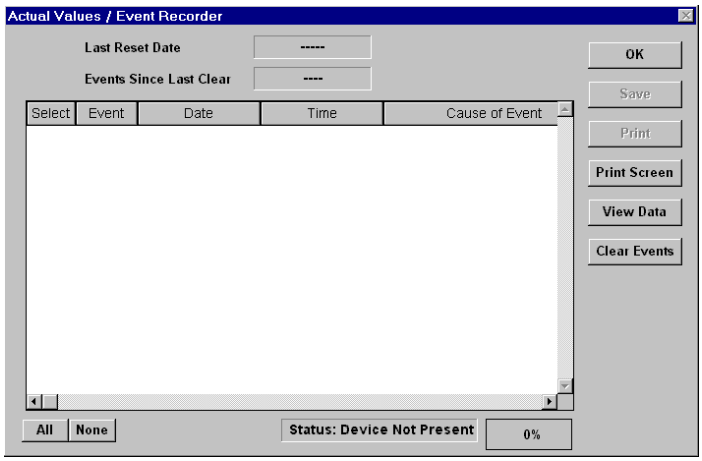
5.3.2 STATISTICS



The digital counter is displayed when one of the digital inputs is set as a digital counter. The digital counter can be cleared in the **Setpoints > S1 Setup** menu item (see Clear/Presets tab). When the digital counter reaches 65535, it is automatically reset to 0.

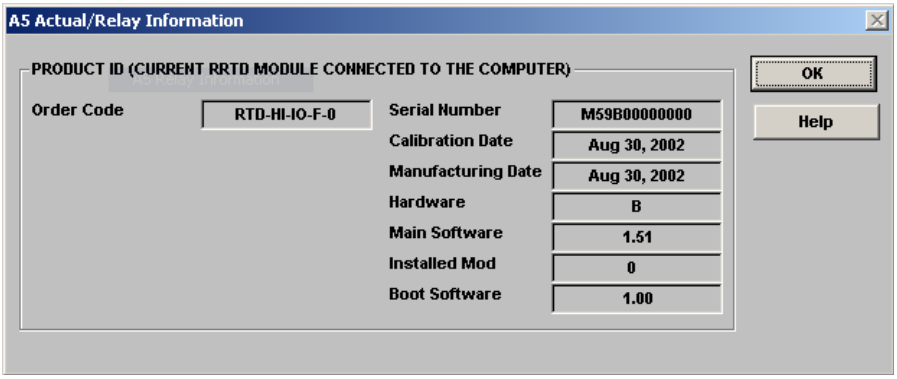
5.4.1 EVENT RECORDER

The event recorder stores system information each time an event occurs (for example, a motor trip). A maximum of 40 events are stored, with **Event 1** representing the oldest event. When the number of events exceeds 40, Event 1 is deleted from the event recorder.



Details of selected events can be viewed by clicking the **View Data** button. Select events by clicking the checkboxes in the Select column. This data can be stored and/or printed for future reference.

5.5.1 A5 RELAY INFORMATION



RRTD model and manufacture information may be viewed here. The last calibration date is the date the relay was last calibrated at GE Multilin. This information reflects the revisions of the software currently running in the RRTD. This information should be noted and recorded before calling for technical support or service.

5.5.2 COMMANDS

RRTD commands are performed through the Commands menu, allowing for the refreshing and resetting of local RRTDs.

a) RESET RRTD

Each individual RRTD can be reset through the commands menu. This is used to reset RRTD units that have the IO option and have a latched trip or alarm active.

b) REFRESH RRTD

The refresh command sends the setpoints that are saved in the master RRTD to the slave. This command is used when replacing a RRTD unit.

6.1.1 RTD CIRCUIT OPERATION

The following is an explanation of how the RTD circuitry works in the RRTD.

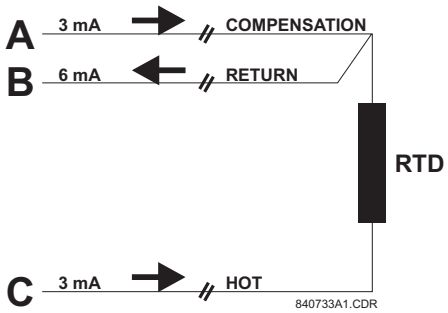


Figure 6–1: RTD CIRCUITRY

A constant current source sends 3 mA DC down legs A and C. A 6 mA DC current returns down leg B. It may be seen that:

$$V_{AB} = V_{LeadA} + V_{LeadB} \quad \text{and} \quad V_{CB} = V_{LeadC} + V_{RTD} + V_{LeadB}$$

or

$$V_{AB} = V_{comp} + V_{return} \quad \text{and} \quad V_{CB} = V_{hot} + V_{RTD} + V_{return}$$

The above holds true providing that all three leads are the same length, gauge, and material, hence the same resistance.

$$R_{LeadA} = R_{LeadB} = R_{LeadC} = R_{Lead}$$

or

$$R_{comp} = R_{return} = R_{hot} = R_{Lead}$$

Electronically, subtracting V_{AB} from V_{BC} leaves only the voltage across the RTD. In this manner lead length is effectively negated:

$$V_{CB} - V_{AB} = (V_{Lead} + V_{RTD} + V_{Lead}) - (V_{Lead} + V_{Lead})$$
$$V_{CB} - V_{AB} = V_{RTD}$$

6.1.2 TWO WIRE RTD LEAD COMPENSATION

An example of how to add lead compensation to a two wire RTD is shown below.

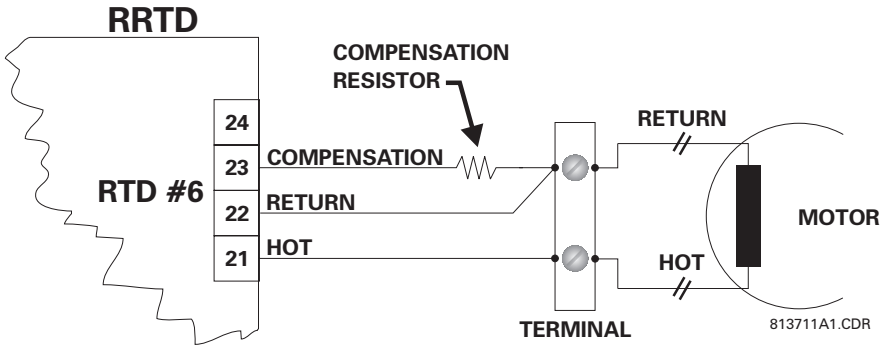


Figure 6–2: 2 WIRE RTD LEAD COMPENSATION

The compensation lead would be added and it would compensate for the Hot and the Return assuming they are all of equal length and gauge. To compensate for resistance of the Hot and Compensation leads, a resistor equal to the resistance of the Hot lead could be added to the compensation lead, though in many cases this is unnecessary.

6.1.3 REDUCED RTD LEAD NUMBER APPLICATION

The RRTD requires three leads to be brought back from each RTD: Hot, Return, and Compensation. In certain situations this can be quite expensive. However, it is possible to reduce the number of leads so that three are required for the first RTD and only one for each successive RTD. Refer to the following diagram for wiring configuration.

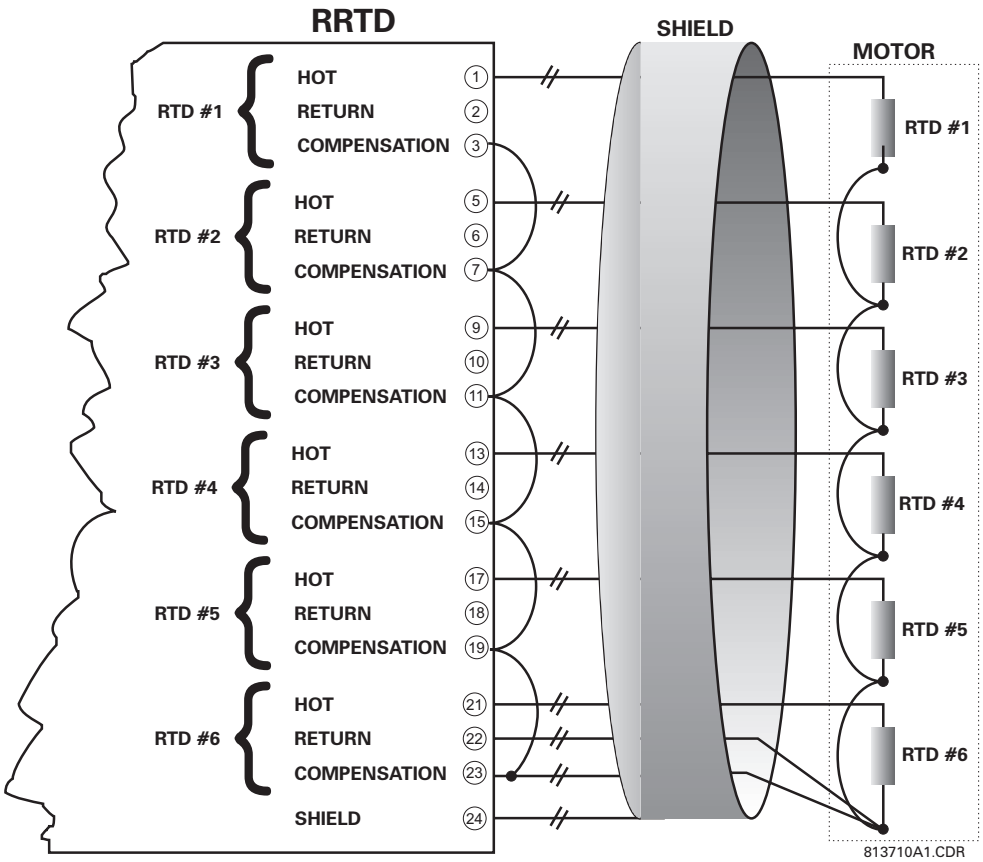


Figure 6–3: REDUCED WIRING RTDs

The Hot line is run as usual for each RTD. However, the Compensation and Return leads need only be run for the first RTD. At the motor RTD terminal box, connect the RTD Return leads together with as short as possible jumpers. At the RRTD unit, the Compensation leads must be jumpered together.

Note that an error is produced on each RTD equal to the voltage drop across the RTD return jumper. This error increases for each successive RTD added as:

$V_{RTD1} = V_{RTD1}$

$V_{RTD2} = V_{RTD2} + V_{J3}$

$V_{RTD3} = V_{RTD3} + V_{J3} + V_{J4}$

$V_{RTD4} = V_{RTD4} + V_{J3} + V_{J4} + V_{J5}$, etc....

This error is directly dependent on the length and gauge of the jumper wires and any error introduced by a poor connection. For RTD types other than 10C, the error introduced by the jumpers is negligible.

Although this RTD wiring technique reduces the cost of wiring, the following disadvantages must be noted:

1. There is an error in temperature readings due to lead and connection resistances. **Not** recommended for 10C RTDs.
2. If the RTD Return lead to the RRTD or one of the jumpers breaks, all RTDs from the point of the break onwards will read open.
3. If the Compensation lead breaks or one of the jumpers breaks, all RTDs from the point of the break onwards will function without any lead compensation.

6.1.4 MONITORING OF UP TO 60 RTDs

A maximum of four (4) RRTD modules with a 369 can be daisy-chained together as illustrated in Figure 6–5: DAISY CHAINING RRTD MODULES on page 6–4. This provides the capability of monitoring up to 60 RTDs.

The 369 Motor Management Relay is designated as the master and the other RRTDs as the slaves. Each of the RRTD slave modules must be programmed with a unique **SLAVE ADDRESS** before they can be daisy-chained together. Programming is accomplished via RTDPC by connecting to either the Channel 1 or Channel 1 RS485 port. When all devices connected to the 369 are communicating properly, the 369PC software can also be used to program individual RRTD modules.

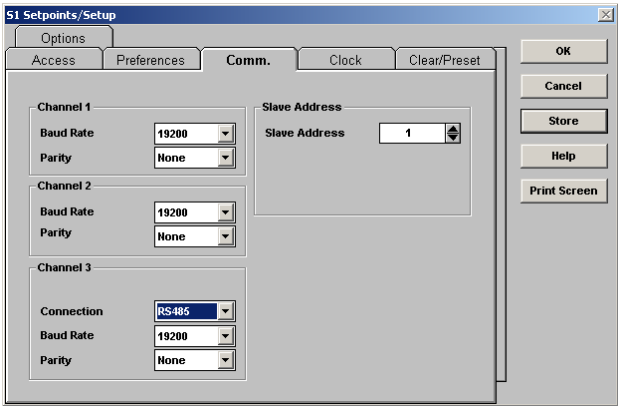


Figure 6–4: RTDPC SCREEN

Since the RRTD does not have a display, a HMI, such as the Quick Panel Jr., can be connected to one of the communication ports. The HMI can be configured to display the information of choice. Visit the GE Multilin Web site to obtain a Quick Panel configuration template.

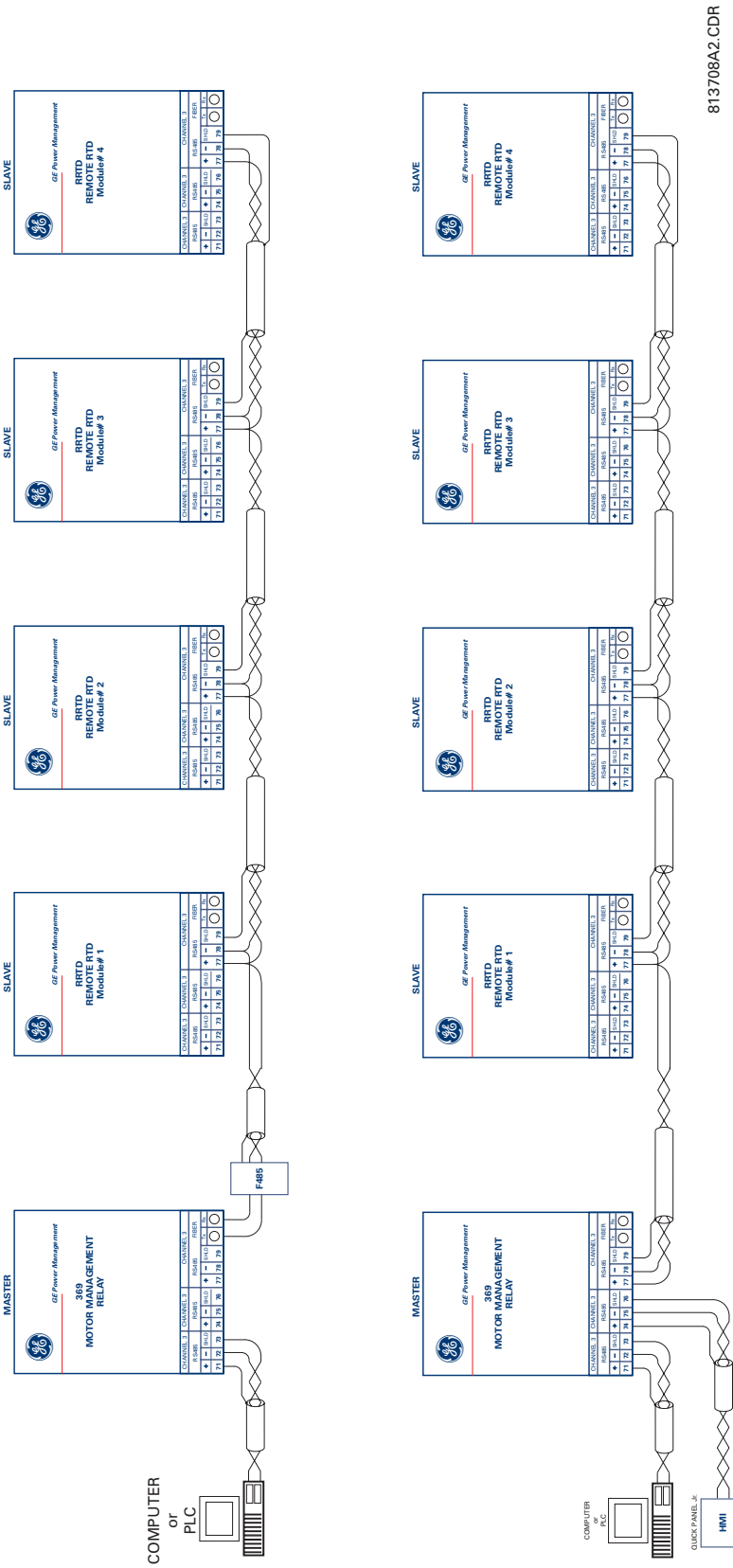


Figure 6–5: DAISY CHAINING RRTD MODULES

6.2.1 INTRODUCTION

Using the RRTD with the 469 eliminates the necessity of wiring RTDs back to the 469 for monitoring and/or control functions.

Any RRTDs used with the 469 MUST have the IO option.

The following three scenarios are addressed in this section: control via the 469, monitoring via the 469, and monitoring *and* control via the 469. Although only three specific scenarios are described, it is possible to use combinations of them. It is up to the customer's discretion to apply them according to their needs.

6.2.2 CONTROL VIA THE 469

Use this setup if the application requires the 469 to control RTD trips and no monitoring by the 469 is required.

1. Wire the RTDs to the RRTD and program the RRTD with trip and alarm levels as described in the RRTD instruction manual. Program all RRTD trips and alarms as unlatched.
2. Wire trip and alarm output relays from the RRTD to the 469 digital input(s). Program the 469 digital input(s) (one or more of the General Switch A-D) and assign the appropriate output relay. The General Switch inputs can be renamed to indicate that it is an RRTD trip or alarm (i.e. RRTD Trip).
3. A trip or alarm from the RRTD will now cause the 469 to issue the trip or alarm to the control scheme. The output relay of the RRTD will reset as soon as the condition is cleared. The 469 output relay will reset according to whether it is programmed as latched or unlatched.
4. If monitoring of the RTD temperatures is required, the data can be read from the RRTD through communications.

6.2.3 MONITORING VIA THE 469

Use this setup if the application requires the RRTD to control tripping and/or alarms and it is desirable to have the 469 monitor RTD temperatures.

1. Wire the RTDs to the RRTD as described in the RRTD instruction manual. If tripping and/or alarms are required, program the RRTD accordingly and wire the RRTD output relays into the control scheme.
2. The RRTD has 4 Analog Outputs that can be wired to the 469 Analog Inputs. They can be programmed to represent individual RTDs or the Hottest Stator RTD.
3. Program the 469 Analog Input Name with the appropriate RTD name (e.g. "Remote RTD1"). Rename the 469 Analog Input Units (e.g. Deg C). Program the input range and minimum/maximum levels to match the RRTD settings.
4. The RTD temperatures can now be monitored by the 469 Analog Input metering data.
5. The RTD temperatures can also be obtained from the 469 through communications (by reading the appropriate Analog Input metering memory map addresses) or by programming the 469 analog outputs appropriately.

6.2.4 MONITORING AND CONTROL VIA THE 469

This setup is to be used if the application requires the 469 to both monitor RTD temperatures and control tripping and/or alarming. This setup provides the most benefit from using the RRTD with the 469.

1. Wire RTDs to the RRTD as described in the RRTD instruction manual. DO NOT wire RRTD output relays into the control scheme and DO NOT program any trips or alarms in the RRTD.
2. Wire the required number of RRTD Analog Outputs to the 469 Analog Inputs. They can be programmed to represent individual RTDs or the Hottest Stator RTD.
3. Program the 469 Analog Input Name with the appropriate RTD name (e.g. "Remote RTD1"). Rename the 469 Analog Input Units (e.g. Deg C). Program the input range and minimum/maximum levels to match the RRTD settings.
4. Program the 469 Analog Inputs with the appropriate trip and/or alarm levels.

5. The RTD temperatures can now be monitored through the 469 Analog Input metering data. The temperatures can also be obtained from the 469 through communications (by reading the appropriate Analog Input metering memory map addresses) or by programming the 469 analog outputs appropriately.
6. The 469 will now control trips and/or alarms for remote RTDs. See the wiring diagram below for details.

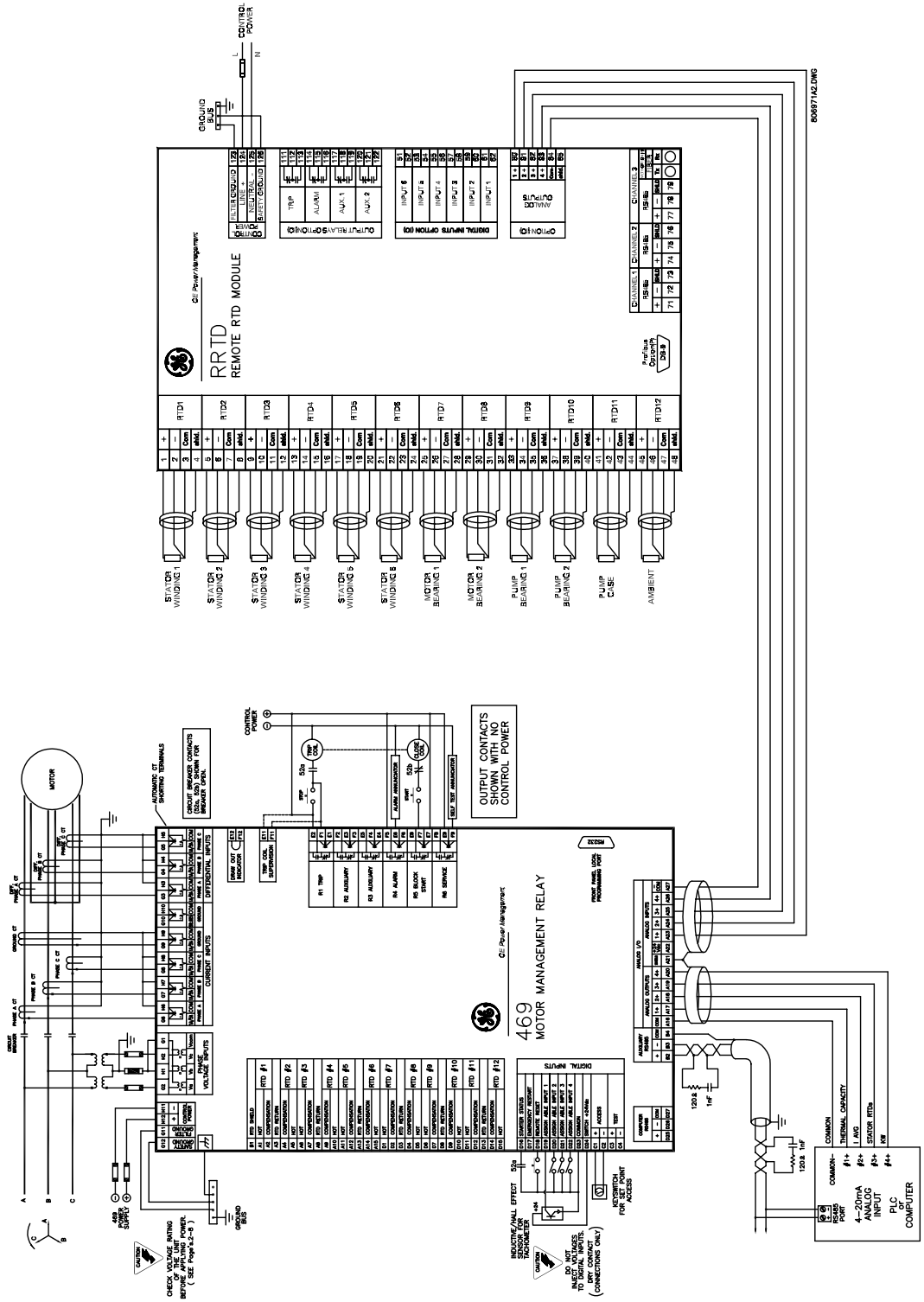


Figure 6–6: RRTD/469 WIRING DIAGRAM

7.1.1 INTRODUCTION

This chapter demonstrates the procedures necessary to perform a complete functional test of all the RRTD hardware while also testing firmware/hardware interaction in the process. Testing of the relay during commissioning wiring is correct and complete.

7.1.2 TEST SETUP

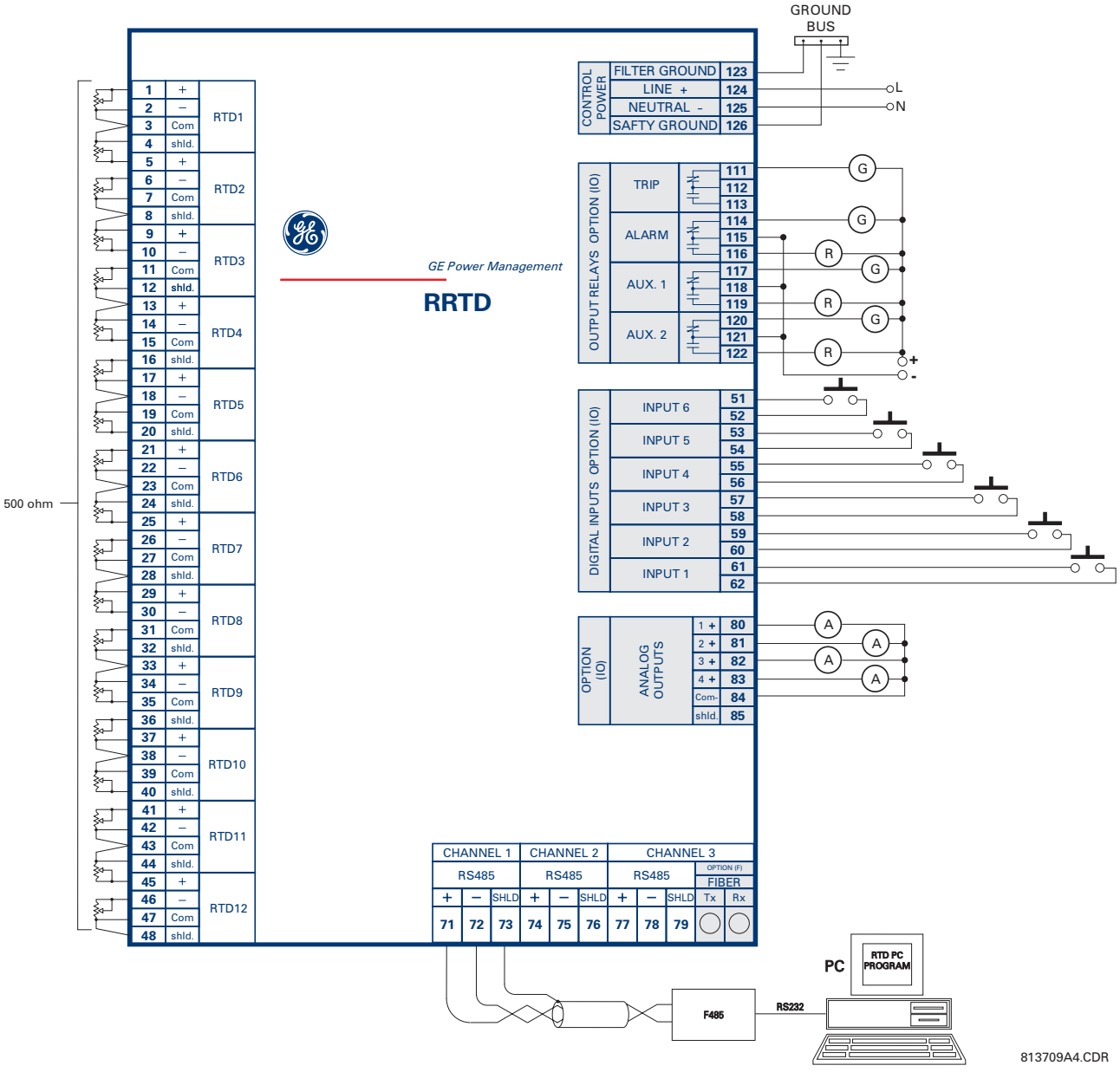


Figure 7–1: SECONDARY INJECTION TEST SETUP

7.2.1 RTD ACCURACY TEST

The RRTD specification for RTD input accuracy is ±2°C. Perform the steps below to verify accuracy.

1. Select an RTD type of 100 Platinum for all of the 12 RTDs.
2. Measured values should be ±2°C or ±4°F. Alter the resistances applied to the RTD inputs as per the table below to simulate RTDs and verify accuracy of the measured values. View the measured values in:

   A2 TEMPERATURE DATA \ LOCAL RTD
3. Select the preferred temperature units for the display. Alter the following setpoint:

   S1 SETUP \ PREFERENCES \ TEMPERATURE DISPLAY: "Celsius" (or "Fahrenheit" if preferred)
4. Repeat the above measurements for the other RTD types (120 Ω Nickel, 100 Ω Nickel and 10 Ω Copper).

APPLIED RESISTANCE 100 Ω PLATINUM	EXPECTED RTD TEMPERATURE READING		MEASURED RTD TEMPERATURE ✓ SELECT ONE: ____(°C) ____(°F)											
	CELSIUS	FAHRENHEIT	1	2	3	4	5	6	7	8	9	10	11	12
80.31 Ω	–50°C	–58°F												
100.00 Ω	0°C	32°F												
119.39 Ω	50°C	122°F												
138.50 Ω	100°C	212°F												
157.32 Ω	150°C	302°F												
175.84 Ω	200°C	392°F												

APPLIED RESISTANCE 120 Ω NICKEL	EXPECTED RTD TEMPERATURE READING		MEASURED RTD TEMPERATURE ✓ SELECT ONE: ____(°C) ____(°F)											
	CELSIUS	FAHRENHEIT	1	2	3	4	5	6	7	8	9	10	11	12
86.17 Ω	–50°C	–58°F												
120.00 Ω	0°C	32°F												
157.74 Ω	50°C	122°F												
200.64 Ω	100°C	212°F												
248.95 Ω	150°C	302°F												
303.46 Ω	200°C	392°F												

APPLIED RESISTANCE 100 Ω NICKEL	EXPECTED RTD TEMPERATURE READING		MEASURED RTD TEMPERATURE ✓ SELECT ONE: ____(°C) ____(°F)											
	CELSIUS	FAHRENHEIT	1	2	3	4	5	6	7	8	9	10	11	12
71.81 Ω	–50°C	–58°F												
100.00 Ω	0°C	32°F												
131.45 Ω	50°C	122°F												
167.20 Ω	100°C	212°F												
207.45 Ω	150°C	302°F												
252.88 Ω	200°C	392°F												

APPLIED RESISTANCE 10 Ω COPPER	EXPECTED RTD TEMPERATURE READING		MEASURED RTD TEMPERATURE ✓ SELECT ONE: ____(°C) ____(°F)											
	CELSIUS	FAHRENHEIT	1	2	3	4	5	6	7	8	9	10	11	12
7.10 Ω	–50°C	–58°F												
9.04 Ω	0°C	32°F												
10.97 Ω	50°C	122°F												
12.90 Ω	100°C	212°F												
14.83 Ω	150°C	302°F												
16.78 Ω	200°C	392°F												
18.73 Ω	250°C	482°F												

7.2.2 DIGITAL INPUTS

The digital inputs can be verified easily with a simple switch or pushbutton. Perform the steps below to verify functionality.

1. Open switches of all of the digital inputs.
2. View the status of the digital inputs and trip coil supervision in:

   A1 STATUS \ DIGITAL INPUT STATUS
3. Close switches of all of the digital inputs. View the status of the digital inputs in:

   A1 STATUS \ DIGITAL INPUT STATUS

INPUT	EXPECTED STATUS (SWITCH OPEN)	✓ PASS × FAIL	EXPECTED STATUS (SWITCH CLOSED)	✓ PASS × FAIL
DIGITAL INPUT 1	Open		Shorted	
DIGITAL INPUT 2	Open		Shorted	
DIGITAL INPUT 3	Open		Shorted	
DIGITAL INPUT 4	Open		Shorted	
DIGITAL INPUT 5	Open		Shorted	
DIGITAL INPUT 6	Open		Shorted	

7.2.3 ANALOG OUTPUTS

The RRTD specification for analog input and analog output accuracy is ±1% of full scale. Perform the steps below to verify accuracy for each of the three analog inputs.

4 TO 20mA ANALOG INPUTS:

1. Alter the following setpoints:

   S5 ANALOG OUTPUTS \ LOCAL ANALOG OUTPUTS \ ANALOG OUT 1 \ ANALOG RANGE: "4-20 mA"
   (repeat for analog inputs 2 to 4)
2. Analog output values should be ±0.2 mA on the ammeter. Force the analog outputs using the following setpoints:

   S6 TESTING \ TEST ANALOG OUTPUTS \ FORCE ANALOG OUTPUT 1: "0%"
   (enter desired percent, repeat for analog outputs 2 to 4)
3. Verify the ammeter readings for all the analog outputs
4. Repeat steps 1 to 3 for the other forced output settings

ANALOG OUTPUT FORCE VALUE	EXPECTED AMMETER READING	MEASURED AMMETER READING (mA)			
		1	2	3	4
0	4 mA				
25	8 mA				
50	12 mA				
75	16 mA				
100	20 mA				

0 TO 1 mA ANALOG INPUTS:

1. Alter the following setpoints:

   S10 ANALOG OUTPUTS \ LOCAL ANALOG OUTPUTS \ ANALOG OUT 1 \ ANALOG RANGE: "0-1 mA"
   (repeat for analog inputs 2 to 4)
2. Analog output values should be ±0.01 mA on the ammeter. Force the analog outputs using the following setpoints:

   S6 TESTING \ TEST ANALOG OUTPUTS \ FORCE ANALOG OUTPUT 1: "0%"
   (enter desired percent, repeat for analog outputs 2 to 4)

3. Verify the ammeter readings for all the analog outputs
4. Repeat 1 to 3 for the other forced output settings

ANALOG OUTPUT FORCE VALUE	EXPECTED AMMETER READING	MEASURED AMMETER READING (mA)			
		1	2	3	4
0	0 mA				
25	0.25 mA				
50	0.5 mA				
75	0.75 mA				
100	1.0 mA				

0 TO 20 mA ANALOG INPUTS:

1. Alter the following setpoints:

   S5 ANALOG OUTPUTS \ LOCAL ANALOG OUTPUTS \ ANALOG OUT 1 \ ANALOG RANGE: "0-20 mA"
   (repeat for analog inputs 2 to 4)

2. Analog output values should be ±0.2mA on the ammeter. Force the analog outputs using the following setpoints:

   S6 TESTING \ TEST ANALOG OUTPUTS \ FORCE ANALOG OUTPUT 1: "0%"
   (enter desired percent, repeat for analog outputs 2 to 4)

3. Verify the ammeter readings for all the analog outputs
4. Repeat 1 to 3 for the other forced output settings

ANALOG OUTPUT FORCE VALUE	EXPECTED AMMETER READING	MEASURED AMMETER READING (mA)			
		1	2	3	4
0	0 mA				
25	5 mA				
50	10 mA				
75	15 mA				
100	20 mA				

7.2.4 OUTPUT RELAYS

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To verify the functionality of the output relays, perform the following steps:

1. Use the following setpoints:

   S6 TESTING \ TEST OUTPUT RELAYS \ FORCE TRIP RELAY: "Energized"
   S6 TESTING \ TEST OUTPUT RELAYS \ FORCE TRIP RELAY DURATION: "Static"

2. Using the above setpoints, individually select each of the other output relays (AUX 1, AUX 2 and ALARM) and verify operation.

FORCE OPERATION SETPOINT	EXPECTED MEASUREMENT (✓ for SHORT)								ACTUAL MEASUREMENT (✓ for SHORT)							
	R1		R2		R3		R4		R1		R2		R3		R4	
	no	nc	no	nc	no	nc	no	nc	no	nc	no	nc	no	nc	no	nc
R1 Trip	✓			✓		✓		✓								
R2 Auxiliary		✓	✓			✓		✓								
R3 Auxiliary		✓		✓	✓			✓								
R4 Alarm		✓		✓		✓	✓									

8.1.1 ELECTRICAL INTERFACE

The electrical interface consists of one of three 2-wire RS485 ports from the rear terminal connector. In a 2-wire RS485 link, data flow is bidirectional and half-duplex; that is, data is not transmitted and received at the same time. RS485 lines should be connected in a daisy-chain configuration (avoid star connections) with a terminating network installed at each end of the link; that is, at the master end and at the slave furthest from the master. The terminating network should be a 120 Ω resistor in series with a 1 nF ceramic capacitor when used with Belden 9841 RS485 wire. The value of the terminating resistors should be equal to the characteristic impedance of the line. This is approximately 120 Ω for standard #22 AWG twisted pair wire. Shielded wire should always be used to minimize noise. Polarity is important in RS485 communications: the '+' terminals of all devices must be connected together for the system to operate. See Section 2.3.8: RS485 COMMUNICATIONS on page 2–6 for details on correct serial port wiring.

When using a fibre optic link the Tx from the RRTD should be connected to the Rx of the Master device and the Rx from the RRTD should be connected to the Tx of the Master device.

8.1.2 MODBUS COMMUNICATIONS

The RRTD implements a subset of the AEG Modicon Modbus RTU protocol. Many popular programmable controllers support this protocol directly with a suitable interface card allowing direct connection. Although the Modbus protocol is hardware independent, the RRTD interfaces are three 2-wire RS485 ports. Modbus is a single master, multiple slave protocol suitable for a multi-drop configuration as provided by RS485 hardware. In this configuration, up to 32 slaves can be daisy-chained together on a single communication channel.

The RRTD is always a slave – it cannot be a master. Computers or PLCs are commonly programmed as masters. The Modbus protocol exists in two versions: Remote Terminal Unit (RTU, binary) and ASCII. Only the RTU version is supported by the RRTD. Monitoring, programming, and control functions are enacted using read/write register commands.

8.1.3 DATA FRAME FORMAT AND DATA RATE

One data frame of an asynchronous transmission to or from an RRTD is default to 1 start bit, 8 data bits, and 1 stop bit. This produces a 10 bit data frame. This is important for transmission through modems at high bit rates (11 bit data frames are not supported by Hayes modems at bit rates of greater than 300 bps). The parity bit is optional as odd or even. If it is programmed as odd or even, the data frame consists of 1 start bit, 8 data bits, 1 parity bit, and 1 stop bit.

The Modbus protocol can be implemented at any standard communication speed. The RRTD RS485, fiber optic, and RS232 ports support operation at 1200, 2400, 4800, 9600, and 19200 baud.

8.1.4 DATA PACKET FORMAT

A complete request/response sequence consists of the following bytes (transmitted as separate data frames):

Master Request Transmission:

SLAVE ADDRESS	- 1 byte
FUNCTION CODE	- 1 byte
DATA	- variable number of bytes depending on FUNCTION CODE
CRC	- 2 bytes

Slave Response Transmission:

SLAVE ADDRESS	- 1 byte
FUNCTION CODE	- 1 byte
DATA	- variable number of bytes depending on FUNCTION CODE
CRC	- 2 bytes

SLAVE ADDRESS: The first byte of every transmission representing the user-assigned address of the slave device. Each slave device must be assigned a unique address – only the addressed slave responds to a transmission that starts with its address. In a master request, the SLAVE ADDRESS identifies slave receiving the request. In a slave response, the SLAVE ADDRESS identifies the slave sending the response. A master transmission with a SLAVE ADDRESS of 0 indicates a broadcast command. Broadcast commands can be used for specific functions.

FUNCTION CODE: The second byte of every transmission. The Modbus protocol defines function codes 1 to 127 (the RRTD implements some of these functions). In a master request, the FUNCTION CODE tells the slave what action to per-

form. If the FUNCTION CODE in a slave response is the same as that sent from the master, then the function was performed as requested. If the high order bit of the FUNCTION CODE sent from the slave is a 1 (i.e. FUNCTION CODE > 127) then the slave did not perform the function as requested and is sending an error or exception response.

DATA: A variable number of bytes depending on the FUNCTION CODE. This may be actual values, setpoints, or addresses sent by the master to the slave or by the slave to the master. Data is sent MSByte first followed by the LSByte.

CRC: This is a two byte error checking code. CRC is sent LSByte first followed by the MSByte.

8.1.5 ERROR CHECKING

The Modbus RTU includes a two byte CRC-16 (16 bit cyclic redundancy check) with every transmission. The CRC-16 algorithm treats the entire data stream (data bits only; start, stop, and parity ignored) as one continuous binary number. This number is shifted left 16 bits and then divided by a characteristic polynomial (11000000000000101B). The 16 bit remainder is appended to the end of the transmission, LSByte first. The resulting message and CRC, when divided by the same polynomial at the receiver, gives a zero remainder if no transmission errors have occurred.

An RRTD Modbus slave device will not respond to transmission with CRC-16 calculation errors. A CRC-16 error indicates than one or more bytes were received incorrectly and should be ignored to avoid incorrect operation. The CRC-16 calculation is an industry standard method used for error detection. An algorithm is included here to assist programmers in situations where no standard CRC-16 calculation routines are available.

8.1.6 CRC-16 ALGORITHM

Once the following algorithm is complete, the working register "A" will contain the CRC value to be transmitted. Note that this algorithm requires the characteristic polynomial to be reverse bit ordered. The MSbit of the characteristic polynomial is dropped since it does not affect the value of the remainder. The following symbols are used in the algorithm:

-->	data transfer
A	16 bit working register
AL	low order byte of A
AH	high order byte of A
CRC	16 bit CRC-16 value
i, j	loop counters
(+)	logical exclusive or operator
Di	i-th data byte (i = 0 to N-1)
G	16 bit characteristic polynomial = 1010000000000001 with MSbit dropped and bit order reversed
shr(x)	shift right (the LSbit of the low order byte of x shifts into a carry flag, a '0' is shifted into the MSbit of the high order byte of x, all other bits shift right one location

The algorithm is as follows:

```
1.  FFFF hex --> A
2.  0 --> i
3.  0 --> j
4.  Di (+) AL --> AL
5.  j+1 --> j
6.  shr(A)
7.  is there a carry?   No: go to 8.; Yes: G (+) A --> A
8.  is j = 8?    No: go to 5.; Yes: go to 9.
9.  i+1 --> i
10. is i = N?    No: go to 3; Yes: go to 11.
11. A --> CRC
```

8.1.7 TIMING

Data packet synchronization is maintained by timing constraints. The receiving device measures the time between the reception of characters. If 3.5 character times elapse without a new character or packet completion, then the communication link must be reset (i.e. all slaves start listening for a new transmission from the master). Thus, at 9600 baud a delay greater than $3.5 \times 1 / 9600 \times 10 = 3.65$ ms resets the communication link.

8.2.1 DESCRIPTION

The following functions are supported by the RRTD:

- 03: Read Setpoints and Actual Values
- 04: Read Setpoints and Actual Values
- 05: Execute Operation
- 06: Store Single Setpoint
- 07: Read Device Status
- 08: Loopback Test
- 16: Store Multiple Setpoints

8.2.2 FUNCTION CODES 03 & 04: READ SETPOINTS & ACTUAL VALUES

Modbus implementation: Read Input and Holding Registers
RRTD Implementation: Read Setpoints and Actual Values

For the RRTD implementation of Modbus, these commands can be used to read any Setpoint ("holding registers") or Actual Value ("input registers"). Holding and input registers are 16 bit (two byte) values transmitted high order byte first. Thus all RRTD Setpoints and Actual Values are sent as two bytes. The maximum number of registers that can be read in one transmission is 125. Function codes 03 and 04 are configured to read setpoints or actual values interchangeably because some PLCs do not support both function codes.

The slave response to these function codes is the slave address, function code, a count of the number of data bytes to follow, the data itself and the CRC. Each data item is sent as a two byte number with the high order byte sent first. The CRC is sent as a two byte number with the low order byte sent first.

MESSAGE FORMAT AND EXAMPLE:

Request slave 11 to respond with 2 registers starting at address 0308. For this example the register data in these addresses is follows – address 0308: 0064; address 0309: 000A.

MASTER TRANSMISSION:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	03	read registers
DATA STARTING ADDRESS	2	03 08	data starting at 0308
NUMBER OF SETPOINTS	2	00 02	2 registers (4 bytes total)
CRC	2	45 27	CRC calculated by the master

SLAVE RESPONSE:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	response message from slave 11
FUNCTION CODE	1	03	read registers
BYTE COUNT	1	04	2 registers = 4 bytes
DATA 1	2	00 64	value in address 0308
DATA 2	2	00 0A	value in address 0309
CRC	2	EB 91	CRC calculated by the slave

8.2.3 FUNCTION CODE 05: EXECUTE OPERATION

Modbus Implementation: Force Single Coil
RRTD Implementation: Execute Operation

This function code allows the master to request an RRTD to perform specific command operations. The command numbers listed in the Commands area of the memory map correspond to operation code for function code 05. The operation commands can also be initiated by writing to the Commands area of the memory map using function code 16. Refer to FUNCTION 16 - STORE MULTIPLE SETPOINTS for complete details.

SUPPORTED OPERATIONS:

- Reset RRTD (operation code 1)
- Start Device (operation code 2)
- Stop Device (operation code 3)

MESSAGE FORMAT AND EXAMPLE – RESET RRTD (OPERATION CODE 1):

MASTER TRANSMISSION:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	05	execute operation
OPERATION CODE	2	00 01	reset RRTD (operation code 1)
CODE VALUE	2	FF 00	perform function
CRC	2	DD 50	CRC calculated by the master

SLAVE RESPONSE:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	response message from slave 11
FUNCTION CODE	1	05	execute operation
OPERATION CODE	2	00 01	reset command (operation code 1)
CODE VALUE	2	FF 00	perform function
CRC	2	EB 91	CRC calculated by the slave

8.2.4 FUNCTION CODE 06 - STORE SINGLE SETPOINT

Modbus Implementation: Preset Single Register
RRTD Implementation: Store Single Setpoint

This command allows the master to store a single setpoint into the memory of an RRTD. The slave response to this function code is to echo the entire master transmission.

MESSAGE FORMAT AND EXAMPLE:

Request slave 11 to store the value 01F4 in Setpoint address 1180. After the transmission in this example is complete, setpoint address 1180 will contain the value 01F4.

MASTER TRANSMISSION:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	06	store single setpoint
DATA STARTING ADDRESS	2	11 80	setpoint address 1180
DATA	2	01 F4	data address 1180
CRC	2	8D A3	CRC calculated by the master

SLAVE RESPONSE:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	response message from slave 11
FUNCTION CODE	1	06	store single setpoint
DATA STARTING ADDRESS	2	11 80	setpoint address 1180
DATA	2	01 F4	data stored in address 1180
CRC	2	EB 91	CRC calculated by the slave

8.2.5 FUNCTION CODE 07: READ DEVICE STATUS

Modbus Implementation: Read Exception Status
RRTD Implementation: Read Device Status

This is a function used to quickly read the status of a selected device. A short message length allows for rapid reading of status. The status byte returned will have individual bits set to 1 or 0 depending on the status of the slave device.

RRTD GENERAL STATUS BYTE:

LSBit B0: Trip relay energized = 1
B1: Aux 1 relay energized = 1
B2: Aux 2 relay energized = 1
B3: Alarm relay energized = 1
B4: Stopped = 1
B5: Starting = 1
B6: Running = 1

MSBit B7: Tripped =1

MESSAGE FORMAT AND EXAMPLE:

MASTER TRANSMISSION:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	07	read device status
CRC	2	47 42	CRC calculated by the master

SLAVE RESPONSE:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	response message from slave 11
FUNCTION CODE	1	07	read device status
DEVICE STATUS	1	59	status = 01011001 in binary
CRC	2	C2 08	CRC calculated by the slave

8.2.6 FUNCTION CODE 08: LOOPBACK TEST

Modbus Implementation: Loopback Test
RRTD Implementation: Loopback Test

This function is used to test the integrity of the communication link. The RRTD will echo the request.

MESSAGE FORMAT AND EXAMPLE:

MASTER TRANSMISSION:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	06	store single setpoint
DATA STARTING ADDRESS	2	11 80	setpoint address 1180
DATA	2	01 F4	data address 1180
CRC	2	8D A3	CRC calculated by the master

SLAVE RESPONSE:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	response message from slave 11
FUNCTION CODE	1	06	store single setpoint
DATA STARTING ADDRESS	2	11 80	setpoint address 1180
DATA	2	01 F4	data stored in address 1180
CRC	2	EB 91	CRC calculated by the slave

8.2.7 FUNCTION CODE 16: STORE MULTIPLE SETPOINTS

Modbus Implementation: Preset Multiple Registers
RRTD Implementation: Store Multiple Setpoints

This function code allows multiple setpoints to be stored into the RRTD memory. Modbus "registers" are 16 bit (two byte) values transmitted high order byte first. Thus all RRTD setpoints are sent as two bytes. The maximum number of Setpoints that can be stored in one transmission is dependent on the slave device. Modbus allows up to a maximum of 60 holding registers to be stored. The RRTD response to this function code is to echo the slave address, function code, starting address, the number of Setpoints stored, and the CRC.

MESSAGE FORMAT AND EXAMPLE:

Request slave 11 to store the value 01F4 to Setpoint address 1180 and the value 01DE to setpoint address 1181. After the transmission in this example is complete, RRTD slave 11 will have the following setpoints information stored – address 1180: 01F4; address 1181: 01DE.

MASTER TRANSMISSION:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	10	store setpoints
DATA STARTING ADDRESS	2	11 80	setpoint address 1180
NUMBER OF SETPOINTS	2	00 02	2 setpoints (4 bytes total)
BYTE COUNT	1	04	4 bytes of data
DATA 1	2	01 F4	data for address 1180
DATA 2	2	01 DE	data for address 1181
CRC	2	DB B1	CRC calculated by the master

SLAVE RESPONSE:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	response message from slave 11
FUNCTION CODE	1	10	store setpoints
DATA STARTING ADDRESS	2	11 80	setpoint address 1180
NUMBER OF SETPOINTS	2	00 02	2 setpoints
CRC	2	45 B6	CRC calculated by the slave

8.2.8 FUNCTION CODE 16: PERFORMING COMMANDS

Some PLCs may not support execution of commands using function code 5 but do support storing multiple setpoints using function code 16. To perform this operation using function code 16 (10H), a certain sequence of commands must be written at the same time to the RRTD. The sequence consists of: Command Function register, Command operation register and Command Data (if required). The Command Function register must be written with the value of 5 indicating an execute operation is requested. The Command Operation register must then be written with a valid command operation number from the list of commands shown in the memory map. The Command Data registers must be written with valid data if the command operation requires data. The selected command will execute immediately upon receipt of a valid transmission.

MESSAGE FORMAT AND EXAMPLE:

Perform a reset on RRTD (operation code 1):

MASTER TRANSMISSION:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	message for slave 11
FUNCTION CODE	1	10	store setpoints
DATA STARTING ADDRESS	2	00 80	setpoint address 0080
NUMBER OF SETPOINTS	2	00 02	2 setpoints (4 bytes total)
BYTE COUNT	1	04	4 bytes of data
COMMAND FUNCTION	2	00 05	data for address 0080
COMMAND OPERATION	2	00 01	data for address 0081
CRC	2	0B D6	CRC calculated by the master

SLAVE RESPONSE:	BYTES	EXAMPLE / DESCRIPTION	
SLAVE ADDRESS	1	0B	response message from slave 11
FUNCTION CODE	1	10	store setpoints
DATA STARTING ADDRESS	2	00 80	setpoint address 0080
NUMBER OF SETPOINTS	2	00 02	2 setpoints
CRC	2	40 8A	CRC calculated by the slave

8.2.9 ERROR RESPONSES

When an RRTD detects an error other than a CRC error, a response will be sent to the master. The MSbit of the FUNCTION CODE byte will be set to 1 (i.e. the function code sent from the slave will be equal to the function code sent from the master plus 128). The following byte will be an exception code indicating the type of error that occurred.

Transmissions received from the master with CRC errors will be ignored by the RRTD.

The slave response to an error (other than CRC error) will be:

- SLAVE ADDRESS: 1 byte
- FUNCTION CODE: 1 byte (with MSbit set to 1)
- EXCEPTION CODE: 1 byte
- CRC: 2 bytes

The RRTD implements the following exception response codes.

- 01: ILLEGAL FUNCTION

The function code transmitted is not one of the functions supported by the RRTD.

- 02: ILLEGAL DATA ADDRESS

The address referenced in the data field transmitted by the master is not an allowable address for the RRTD.

- 03: ILLEGAL DATA VALUE

The value referenced in the data field transmitted by the master is not within range for the selected data address.

8.3.1 DESCRIPTION

The data stored in the RRTD is grouped as Setpoints and Actual Values. Setpoints can be read and written by a master computer. Actual Values are read only. All Setpoints and Actual Values are stored as two byte values. That is, each register address is the address of a two byte value. Addresses are listed in hexadecimal. Data values (Setpoint ranges, increments, factory values) are in decimal.

Note: Many Modbus communications drivers add 40001d to the actual address of the register addresses. For example: if address 0h was to be read, 40001d would be the address required by the Modbus communications driver; if address 320h (800d) was to be read, 40801d would be the address required by the Modbus communications driver.

8.3.2 USER DEFINABLE MEMORY MAP AREA

The RRTD has a powerful feature, called the User Definable Memory Map, which allows a computer to read up to 124 non-consecutive data registers (setpoints or actual values) by using one Modbus packet. It is often necessary for a master computer to continuously poll various values in each of the connected slave relays. If these values are scattered throughout the memory map, reading them would require numerous transmissions and would burden the communication link. The User Definable Memory Map can be programmed to join any memory map address to one in the block of consecutive User Map locations, so that they can be accessed by reading these consecutive locations.

The User Definable area has two sections:

1. A Register Index area (memory map addresses 0180h to 01FCh) that contains 125 actual values or setpoints register addresses.
2. A Register area (memory map addresses 0100h to 017Ch) that contains data at the addresses in the register index.

Register data that is separated in the rest of the memory map may be remapped to adjacent register addresses in the User Definable Registers area. This is accomplished by writing to register addresses in the User Definable Register Index area. This allows for improved through-put of data and can eliminate the need for multiple read command sequences.

For example, if the values of Average Phase Current (register address 0306h) and Hottest Stator RTD Temperature (register address 0320h) are required to be read from an RRTD, their addresses may be remapped as follows:

1. Write 0306h to address 0180h (User Definable Register Index 0000) using function code 06 or 16.
2. Write 0320h to address 0181h (User Definable Register Index 0001) using function code 06 or 16.

A read (function code 03 or 04) of registers 0100h (User Definable Register 0000) will return the Phase A Current and register 0101h (User Definable Register 0001) will return Hottest Stator RTD Temperature.

Table 8–1: MEMORY MAP (Sheet 1 of 11)

ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
PRODUCT ID (ADDRESSES 0000 TO 007F)							
PRODUCT ID							
0000	GE Multilin Product Code	-	-	-	-	F1	53
0001	Product Hardware Revision	1	26	1	N/A	F15	A
0002	Firmware Revision	N/A	N/A	N/A	N/A	F16	N/A
0003	Modification Number	0	999	1	N/A	F1	0
0004	Boot Revision	0	999	1	-	F1	0
0005	Boot Mod Number	-	-	-	-	-	-
0006	Reserved	-	-	-	-	-	-
0007	Reserved	-	-	-	-	-	-
0008	Order Code	0	63	1	N/A		0
↓	↓	-	-	-	-	-	-
000F	Modify Options	0	N/A	-	N/A	N/A	-
0010	Modify Options Passcode Characters 1 & 2	32	127	1	-	F1	" "
↓	↓	-	-	-	-	-	-
0017	Modify Options Passcode Characters 15 & 16	32	127	1	-	F1	" "
---	Reserved	-	-	-	-	-	-
0020	Serial Number character 1 and 2	N/A	N/A	N/A	ASCII	F22	N/A
0021	Serial Number character 3 and 4	N/A	N/A	N/A	ASCII	F22	N/A
0022	Serial Number character 5 and 6	N/A	N/A	N/A	ASCII	F22	N/A
0023	Serial Number character 7 and 8	N/A	N/A	N/A	ASCII	F22	N/A
0024	Serial Number character 9 and 10	N/A	N/A	N/A	ASCII	F22	N/A
0025	Serial Number character 11 and 12	N/A	N/A	N/A	ASCII	F22	N/A
...	Reserved	-	-	-	-	-	-
0030	Calibration Date	1995	2094	1	-	F18	Jan.1,1999
...	Reserved	-	-	-	-	-	-
0040	Manufacturing Date	1995	2094	1	-	F18	Jan.1,1999
...	Reserved	-	-	-	-	-	-
SETPOINT ACCESS							
0050	Keypad Access Level	0	1	1	N/A	F162	0
0051	Comm Access Level	0	1	1	N/A	F162	0
0052	Access Password Character 1 and 2	32	127	1	-	F1	" "
0053	Access Password Character 3 and 4	32	127	1	-	F1	" "
0054	Access Password Character 5 and 6	32	127	1	-	F1	" "
0055	Access Password Character 7 and 8	32	127	1	-	F1	
0056	Encrypted Access Password 1 and 2	32	127	1	-	F1	“AI”
0057	Encrypted Access Password 3 and 4	32	127	1	-	F1	“KF”
0058	Encrypted Access Password 5 and 6	32	127	1	-	F1	“BA”
0059	Encrypted Access Password 7 and 8	32	127	1	-	F1	IK”
...	Reserved	-	-	-	-	-	-
COMMANDS (ADDRESSES 0000 TO 00FF)							
0080	Command Function Code	0	12	1	-	F31	0
...	Reserved						
USER MAP (ADDRESSES 0100 TO 017F)							
0100	User Map Value # 1	---	---	---	---	---	---
↓	↓						
017C	User Map Value # 125	---	---	---	---	---	---
...	Reserved						
0180	User Map Address # 1	0	3FFF	1	hex	F1	0
↓	↓						
01FC	User Map Address # 125	0	3FFF	1	hex	F1	0
...	Reserved						
ACTUAL VALUES (ADDRESSES 0220 TO 0FFF)							
LAST TRIP DATA							
0220	Cause of Last Trip	0	276	1	-	F134	0
0221	Time of Last Trip (2 words)	N/A	N/A	N/A	N/A	F19	-

Table 8–1: MEMORY MAP (Sheet 2 of 11)

ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
0223	Date of Last Trip (2 words)	N/A	N/A	N/A	N/A	F18	-
...	Reserved	-	-	-	-	-	-
ALARM STATUS							
0260	Digital Input 6 Alarm Status	0	4	1	-	F123	0
0261	Digital Input 2 Alarm Status	0	4	1	-	F123	0
0262	Digital Input 5 Alarm Status	0	4	1	-	F123	0
0263	Digital Input 4 Alarm Status	0	4	1	-	F123	0
0264	Digital Input 1 Alarm Status	0	4	1	-	F123	0
0265	Digital Input 3 Alarm Status	0	4	1	-	F123	0
...	Reserved	-	-	-	-	-	-
027D	Local RTD #1 Alarm Status	0	4	1	-	F123	0
027E	Local RTD #2 Alarm Status	0	4	1	-	F123	0
027F	Local RTD #3 Alarm Status	0	4	1	-	F123	0
0280	Local RTD #4 Alarm Status	0	4	1	-	F123	0
0281	Local RTD #5 Alarm Status	0	4	1	-	F123	0
0282	Local RTD #6 Alarm Status	0	4	1	-	F123	0
0283	Local RTD #7 Alarm Status	0	4	1	-	F123	0
0284	Local RTD #8 Alarm Status	0	4	1	-	F123	0
0285	Local RTD #9 Alarm Status	0	4	1	-	F123	0
0286	Local RTD #10 Alarm Status	0	4	1	-	F123	0
0287	Local RTD #11 Alarm Status	0	4	1	-	F123	0
0288	Local RTD #12 Alarm Status	0	4	1	-	F123	0
0289	Local RTD #1 High Alarm Status	0	4	1	-	F123	0
028A	Local RTD #2 High Alarm Status	0	4	1	-	F123	0
028B	Local RTD #3 High Alarm Status	0	4	1	-	F123	0
028C	Local RTD #4 High Alarm Status	0	4	1	-	F123	0
028D	Local RTD #5 High Alarm Status	0	4	1	-	F123	0
028E	Local RTD #6 High Alarm Status	0	4	1	-	F123	0
028F	Local RTD #7 High Alarm Status	0	4	1	-	F123	0
0290	Local RTD #8 High Alarm Status	0	4	1	-	F123	0
0291	Local RTD #9 High Alarm Status	0	4	1	-	F123	0
0292	Local RTD #10 High Alarm Status	0	4	1	-	F123	0
0293	Local RTD #11 High Alarm Status	0	4	1	-	F123	0
0294	Local RTD #12 High Alarm Status	0	4	1	-	F123	0
0295	Broken / Open RTD Alarm Status	0	4	1	-	F123	
0296	Short / Low Temp Alarm Status	0	1	1	-	F123	
0297	Lost Remote RTD Communication	0	4	1	-	F123	
0298	Trip Counter Alarm Status	0	4	1	-	F123	0
...	Reserved	-	-	-	-	-	-
029E	Self Test Alarm						
...	Reserved	-	-	-	-	-	-
DIGITAL INPUT STATUS							
02D0	Digital Input 3	0	1	1	-	F131	0
02D1	Digital Input 4	0	1	1	-	F131	0
02D2	Digital Input 6	0	1	1	-	F131	0
02D3	Digital Input 5	0	1	1	-	F131	0
02D4	Digital Input 2	0	1	1	-	F131	0
02D5	Digital Input 1	0	1	1	-	F131	0
...	Reserved						
OUTPUT RELAY STATUS							
02E0	Trip	0	2	1	N/A	F150	2
02E1	Alarm	0	2	1	N/A	F150	2
02E2	Aux.1	0	2	1	N/A	F150	2
02E3	Aux.2	0	2	1	N/A	F150	2
...	Reserved						
REAL TIME CLOCK							
02F0	Date (Read Only)	N/A	N/A	N/A	N/A	F18	N/A
02F4	Time (Read Only)	N/A	N/A	N/A	N/A	F19	N/A
...	Reserved						

Table 8–1: MEMORY MAP (Sheet 3 of 11)

ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
TEMPERATURE							
031F	Hottest Stator RTD Number	0	12	1	-	F1	0
0320	Hottest Stator RTD Temperature	-40	200	1	°C	F4	40
0321	Local RTD #1 Temperature	-40	200	1	°C	F4	40
0322	Local RTD #2 Temperature	-40	200	1	°C	F4	40
0323	Local RTD #3 Temperature	-40	200	1	°C	F4	40
0324	Local RTD #4 Temperature	-40	200	1	°C	F4	40
0325	Local RTD #5 Temperature	-40	200	1	°C	F4	40
0326	Local RTD #6 Temperature	-40	200	1	°C	F4	40
0327	Local RTD #7 Temperature	-40	200	1	°C	F4	40
0328	Local RTD #8 Temperature	-40	200	1	°C	F4	40
0329	Local RTD #9 Temperature	-40	200	1	°C	F4	40
032A	Local RTD #10 Temperature	-40	200	1	°C	F4	40
032B	Local RTD #11 Temperature	-40	200	1	°C	F4	40
032C	Local RTD #12 Temperature	-40	200	1	°C	F4	40
...	Reserved						
RTD MAXIMUMS							
03E0	Local RTD # 1 Max. Temperature	-40	200	1	°C	F4	40
03E1	Local RTD # 2 Max. Temperature	-40	200	1	°C	F4	40
03E2	Local RTD # 3 Max. Temperature	-40	200	1	°C	F4	40
03E3	Local RTD # 4 Max. Temperature	-40	200	1	°C	F4	40
03E4	Local RTD # 5 Max. Temperature	-40	200	1	°C	F4	40
03E5	Local RTD # 6 Max. Temperature	-40	200	1	°C	F4	40
03E6	Local RTD # 7 Max. Temperature	-40	200	1	°C	F4	40
03E7	Local RTD # 8 Max. Temperature	-40	200	1	°C	F4	40
03E8	Local RTD # 9 Max. Temperature	-40	200	1	°C	F4	40
03E9	Local RTD # 10 Max. Temperature	-40	200	1	°C	F4	40
03EA	Local RTD # 11 Max. Temperature	-40	200	1	°C	F4	40
03EB	Local RTD # 12 Max. Temperature	-40	200	1	°C	F4	40
...	Reserved						
TRIP COUNTERS							
0430	Total Number of Trips	0	50000	1	-	F1	0
...	Reserved						
0433	Switch Trips	0	50000	1	-	F1	0
...	Reserved						
044E	Stator RTD Trips	0	50000	1	-	F1	0
044F	Bearing RTD Trips	0	50000	1	-	F1	0
0450	Other RTD Trips	0	50000	1	-	F1	0
0451	Ambient RTD Trips	0	50000	1	-	F1	0
...	Reserved						
0457	Trip Counters Last Cleared	N/A	N/A	N/A	N/A	F18	N/A
...	Reserved						
SETPOINTS (ADDRESSES 1000 TO 1FFF)							
DISPLAY PREFERENCES							
1000	Default Message Cycle Time	5	100	1	s	F1	20
1001	Default Message Timeout	10	900	1	s	F1	300
1002	Contrast Adjustment	1	254	1	-	F1	145
1003	Flash Message	1	10	1	s	F1	2
1004	Temperature Display Units	0	1	1	-	F100	0
...	Reserved						
RRTD COMMUNICATIONS							
1010	Slave Address	1	254	1	-	F1	254
1011	Computer RS232 Baud Rate	0	4	1	-	F101	4
1012	Computer RS232 Parity	0	2	1	-	F102	0
1013	CHANNEL 1 Parity	0	2	1	-	F102	4
1014	CHANNEL 1 Baud Rate	0	4	1	-	F101	0
1015	CHANNEL 2 Parity	0	2	1	-	F102	4
1016	CHANNEL 2 Baud Rate	0	4	1	-	F101	0
1017	CHANNEL 3 Parity	0	2	1	-	F102	4

Table 8–1: MEMORY MAP (Sheet 4 of 11)

ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
1018	CHANNEL 3 Baud Rate	0	4	1	-	F101	0
1019	CHANNEL 3 Connection	0	1	1	-	F151	0
101A	CHANNEL 3 Application	0	1	1	-	F149	0
...	Reserved						
REAL TIME CLOCK							
1030	Date (2 words)	valid	date	N/A	-	F18	-
1034	Time (2 words)	valid	time	N/A	-	F19	-
...	Reserved						
MESSAGE SCRATCHPAD							
1060	1st & 2nd Character of 1st Scratchpad Message	32	127	1	-	F1	'T'
↓	↓						
1073	39th & 40th Character of 1st Scratchpad Message	32	127	1	-	F1	" "
1074	1st & 2nd Character of 2nd Scratchpad Message	32	127	1	-	F1	'T'
↓	↓						
1087	39th & 40th Character of 2nd Scratchpad Message	32	127	1	-	F1	" "
1088	1st & 2nd Character of 3rd Scratchpad Message	32	127	1	-	F1	'T'
↓	↓						
109B	39th & 40th Character of 3rd Scratchpad Message	32	127	1	-	F1	" "
109C	1st & 2nd Character of 4th Scratchpad Message	32	127	1	-	F1	'T'
↓	↓						
10AF	39th & 40th Character of 4th Scratchpad Message	32	127	1	-	F1	" "
10B0	1st & 2nd Character of 5th Scratchpad Message	32	127	1	-	F1	'T'
↓	↓						
10C3	39th & 40th Character of 5th Scratchpad Message	32	127	1	-	F1	" "
...	Reserved						
CLEAR PRESET DATA							
1130	Clear Last Trip Data	0	1	1	-	F103	0
1131	Reserved	-	-	-	-	-	-
1132	Clear RTD Maximums	0	1	1	-	F103	0
1133	Reserved	-	-	-	-	-	-
1134	Clear Trip Counters	0	1	1	-	F103	0
1135	Preset Digital Counter	0	65535	1	-	F1	0
1136	Clear Event Records	0	1	1	-	F103	0
...	Reserved						
1143	RRTD 1 - Preset Digital Counter	0	65535	1	-	F1	0
1145	RRTD 2 - Preset Digital Counter	0	65535	1	-	F1	0
1147	RRTD 3 - Preset Digital Counter	0	65535	1	-	F1	0
1149	RRTD 4 - Preset Digital Counter	0	65535	1	-	F1	0
...	Reserved						
DIGITAL COUNTER							
12E6	First Character of Counter Name	32	127	1	-	F1	"G"
12F2	First Character of Counter Unit Name	32	127	1	-	F1	'U'
12F8	Counter Type	0	1	1	-	F114	0
12F9	Digital Counter Alarm	0	2	1	-	F115	0
12FA	Assign Alarm Relays	0	6	1	-	F113	0
12FB	Counter Alarm Level	0	65535	1	-	F1	100
12FD	Reserved	-	-	-	-	-	-
12FE	Record Alarms as Events	0	1	1	-	F103	0
DIGITAL INPUT 2							
1330	1st & 2nd Character of Digital Input 2 Name	32	127	1	-	F22	'G'
1340	General Digital Input 2 Type	0	1	1	-	F116	0
1341	General Digital Input 2 Block Input From Start	0	5000	1	s	F1	0
1342	General Digital Input 2 Alarm	0	2	1	-	F115	0
1343	General Digital Input 2 Alarm Relays	0	6	1	-	F113	0
1344	General Digital Input 2 Alarm Delay	1	50000	1	100ms	F2	50
1345	General Digital Input 2 Alarm Events	0	1	1	-	F103	0
1346	General Digital Input 2 Trip	0	2	1	-	F115	0
1347	General Digital Input 2 Trip Relays	0	6	1	-	F111	0
1348	General Digital Input 2 Trip Delay	1	50000	1	100ms	F2	50

Table 8–1: MEMORY MAP (Sheet 5 of 11)

ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
1349	Digital Input 2 Assignable Function	0	7	1	-	F163	0
...	Reserved						
DIGITAL INPUT 5							
1370	1st & 2nd Character of Digital Input 5 Name	32	127	1	-	F22	'G'
1380	General Digital Input 5 Type	0	1	1	-	F116	0
1381	General Digital Input 5 Block Input From Start	0	5000	1	s	F1	0
1382	General Digital Input 5 Alarm	0	2	1	-	F115	0
1383	General Digital Input 5 Alarm Relays	0	7	1	-	F113	1
1384	General Digital Input 5 Alarm Delay	1	50000	1	100ms	F2	50
1385	General Digital Input 5 Alarm Events	0	1	1	-	F103	0
1386	General Digital Input 5 Trip	0	2	1	-	F115	0
1387	General Digital Input 5 Trip Relays	0	7	1	-	F111	1
1388	General Digital Input 5 Trip Delay	1	50000	1	100ms	F2	50
1389	Digital Input 5 Assignable Function	0	7	1	-	F163	0
...	Reserved						
DIGITAL INPUT 4							
13A0	1st & 2nd Character of Digital Input 4 Name	32	127	1	-	F22	'G'
13B0	General Digital Input 4 Type	0	1	1	-	F116	0
13B1	General Digital Input 4 Block Input from Start	0	5000	1	s	F1	0
13B2	General Digital Input 4 Alarm	0	2	1	-	F115	0
13B3	General Digital Input 4 Alarm Relays	0	7	1	-	F113	1
13B4	General Digital Input 4 Alarm Delay	1	50000	1	100ms	F2	50
13B5	General Digital Input 4 Alarm Events	0	1	1	-	F103	0
13B6	General Digital Input 4 Trip	0	2	1	-	F115	0
13B7	General Digital Input 4 Trip Relays	0	7	1	-	F111	1
13B8	General Digital Input 4 Trip Delay	1	50000	1	100ms	F2	50
13B9	Digital Input 4 Assignable Function	0	7	1	-	F163	0
...	Reserved						
DIGITAL INPUT 1							
13D0	1st & 2nd Character of Digital Input 1 Name	32	127	1	-	F22	'G'
13E0	General Digital Input 1 Type	0	1	1	-	F116	0
13E1	General Digital Input 1 Block Input From Start	0	5000	1	s	F1	0
13E2	General Digital Input 1 Alarm	0	2	1	-	F115	0
13E3	General Digital Input 1 Alarm Relays	0	7	1	-	F113	1
13E4	General Digital Input 1 Alarm Delay	1	50000	1	100ms	F2	50
13E5	General Digital Input 1 Alarm Events	0	1	1	-	F103	0
13E6	General Digital Input 1 Trip	0	2	1	-	F115	0
13E7	General Digital Input 1 Trip Relays	0	7	1	-	F111	1
13E8	General Digital Input 1 Trip Delay	1	50000	1	100ms	F2	50
13E9	Digital Input 1 Assignable Function	0	7	1	-	F163	0
...	Reserved						
DIGITAL INPUT 6							
1400	1st & 2nd Character of Digital Input 6 Name	32	127	1	-	F22	'G'
1410	General Digital Input 6 Type	0	1	1	-	F116	0
1411	General Digital Input 6 Block Input From Start	0	5000	1	s	F1	0
1412	General Digital Input 6 Alarm	0	2	1	-	F115	0
1413	General Digital Input 6 Alarm Relays	0	7	1	-	F113	1
1414	General Digital Input 6 Alarm Delay	1	50000	1	100ms	F2	50
1415	General Digital Input 6 Alarm Events	0	1	1	-	F103	0
1416	General Digital Input 6 Trip	0	1	1	-	F115	0
1417	General Digital Input 6 Trip Relays	0	7	1	-	F111	1
1418	General Digital Input 6 Trip Delay	1	50000	1	100 ms	F2	50
1419	Digital Input 6 Assignable Function	0	7	1	-	F163	0
...	Reserved						
DIGITAL INPUT 3							
1420	1st & 2nd Character of Digital Input 3 Name	32	127	1	-	F22	'G'
1430	General Digital Input 3 Type	0	1	1	-	F116	0
1431	General Digital Input 3 Block Input From Start	0	5000	1	s	F1	0
1432	General Digital Input 3 Alarm	0	2	1	-	F115	0

Table 8–1: MEMORY MAP (Sheet 6 of 11)

ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
1433	General Digital Input 3 Alarm Relays	0	7	1	-	F113	1
1434	General Digital Input 3 Alarm Delay	1	50000	1	100ms	F2	50
1435	General Digital Input 3 Alarm Events	0	1	1	-	F103	0
1436	General Digital Input 3 Trip	0	1	1	-	F115	0
1437	General Digital Input 3 Trip Relays	0	7	1	-	F111	1
1438	General Digital Input 3 Trip Delay	1	50000	1	100 ms	F2	50
1439	Digital Input 3 Assignable Function	0	7	1	-	F163	0
...	Reserved						
OUTPUT RELAY SETUP							
1504	Trip Relay Operation	0	1	1	-	F161	0
1505	Alarm Relay Operation	0	1	1	-	F161	1
1506	Aux1 Relay Operation	0	1	1	-	F161	1
1507	Aux2 Relay Operation	0	1	1	-	F161	0
...	Reserved						
LOCAL RTD #1							
1790	Local RTD #1 Application	0	4	1	-	F121	0
1791	Local RTD #1 High Alarm	0	2	1	-	F115	0
1792	Local RTD #1 High Alarm Relays	0	7	1	-	F113	2
1793	Local RTD #1 High Alarm Level	1	200	1	°C	F1	130
1794	Local RTD #1 Alarm	0	2	1	-	F115	0
1795	Local RTD #1 Alarm Relays	0	7	1	-	F113	1
1796	Local RTD #1 Alarm Level	1	200	1	°C	F1	130
1797	Record RTD #1 Alarms as Events	0	1	1	-	F103	0
1798	Local RTD #1 Trip	0	2	1	-	F115	0
1799	Enable RTD #1 Trip Voting	0	13	1	-	F122	1
179A	Local RTD #1 Trip Relays	0	7	1	-	F111	1
179B	Local RTD #1 Trip Level	1	200	1	°C	F1	130
179C	Local RTD #1 RTD Type	0	3	1	-	F120	0
17A0	First Character of Local RTD #1 Name	32	127	1	-	F1	'R'
↓	↓	-	-	-	-	-	-
17A3	8th Character of Local RTD #1 Name	32	127	1	-	F1	" "
...	Reserved						
LOCAL RTD #2							
17B0	Local RTD #2 Application	0	4	1	-	F121	0
17B1	Local RTD #2 High Alarm	0	2	1	-	F115	0
17B2	Local RTD #2 High Alarm Relays	0	7	1	-	F113	2
17B3	Local RTD #2 High Alarm Level	1	200	1	°C	F1	130
17B4	Local RTD #2 Alarm	0	2	1	-	F115	0
17B5	Local RTD #2 Alarm Relays	0	7	1	-	F113	1
17B6	Local RTD #2 Alarm Level	1	200	1	°C	F1	130
17B7	Record RTD #2 Alarms as Events	0	1	1	-	F103	0
17B8	Local RTD #2 Trip	0	2	1	-	F 115	0
17B9	Enable RTD #2 Trip Voting	0	13	1	-	F122	1
17BA	Local RTD #2 Trip Relays	0	7	1	-	F111	1
17BB	Local RTD #2 Trip Level	1	200	1	°C	F1	130
17BC	Local RTD #2 RTD Type	0	3	1	-	F120	0
17C0	First Character of Local RTD #2 Name	32	127	1	-	F1	'R'
↓	↓						
17C3	8th Character of Local RTD #2 Name	32	127	1	-	F1	" "
...	Reserved						
LOCAL RTD #3							
17D0	Local RTD #3 Application	0	4	1	-	F121	0
17D1	Local RTD #3 High Alarm	0	2	1	-	F115	0
17D2	Local RTD #3 High Alarm Relays	0	7	1	-	F113	2
17D3	Local RTD #3 High Alarm Level	1	200	1	°C	F1	130
17D4	Local RTD #3 Alarm	0	2	1	-	F115	0
17D5	Local RTD #3 Alarm Relays	0	7	1	-	F113	1
17D6	Local RTD #3 Alarm Level	1	200	1	°C	F1	130
17D7	Record RTD #3 Alarms as Events	0	1	1	-	F103	0

Table 8–1: MEMORY MAP (Sheet 7 of 11)

ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
17D8	Local RTD #3 Trip	0	2	1	-	F115	0
17D9	Enable RTD #3 Trip Voting	0	13	1	-	F122	1
17DA	Local RTD #3 Trip Relays	0	7	1	-	F111	1
17DB	Local RTD #3 Trip Level	1	200	1	°C	F1	130
17DC	Local RTD #3 RTD Type	0	3	1	-	F120	0
17E0	First Character of Local RTD #3 Name	32	127	1	-	F1	'R'
↓	↓						
17E3	8th Character of Local RTD #3 Name	32	127	1	-	F1	" "
...	Reserved						
LOCAL RTD #4							
17F0	Local RTD #4 Application	0	4	1	-	F121	0
17F1	Local RTD #4 High Alarm	0	2	1	-	F115	0
17F2	Local RTD #4 High Alarm Relays	0	7	1	-	F113	2
17F3	Local RTD #4 High Alarm Level	1	200	1	°C	F1	130
17F4	Local RTD #4 Alarm	0	2	1	-	F115	0
17F5	Local RTD #4 Alarm Relays	0	7	1	-	F113	1
17F6	Local RTD #4 Alarm Level	1	200	1	°C	F1	130
17F7	Enable RTD #4 Alarms as Events	0	1	1	-	F103	0
17F8	Local RTD #4 Trip	0	2	1	-	F115	0
17F9	Enable RTD #4 Trip Voting	0	13	1	-	F122	1
17FA	Local RTD #4 Trip Relays	0	7	1	-	F111	1
17FB	Local RTD #4 Trip Level	1	200	1	°C	F1	130
17FC	Local RTD #4 RTD Type	0	3	1	-	F120	0
1800	First Character of Local RTD #4 Name	32	127	1	-	F1	'R'
↓	↓						
1803	8th Character of Local RTD #4 Name	32	127	1	-	F1	" "
...	Reserved						
LOCAL RTD #5							
1810	Local RTD #5 Application	0	4	1	-	F121	0
1811	Local RTD #5 High Alarm	0	2	1	-	F115	0
1812	Local RTD #5 High Alarm Relays	0	7	1	-	F113	1
1813	Local RTD #5 High Alarm Level	1	200	1	°C	F1	130
1814	Local RTD #5 Alarm	0	2	1	-	F115	0
1815	Local RTD #5 Alarm Relays	0	7	1	-	F113	1
1816	Local RTD #5 Alarm Level	1	200	1	°C	F1	130
1817	Record RTD #5 Alarms as Events	0	1	1	-	F103	0
1818	Local RTD #5 Trip	0	2	1	-	F115	0
1819	Enable RTD #5 Trip Voting	0	13	1	-	F122	1
181A	Local RTD #5 Trip Relays	0	7	1	-	F111	1
181B	Local RTD #5 Trip Level	1	200	1	°C	F1	130
181C	Local RTD #5 RTD Type	0	3	1	-	F120	0
1820	First Character of Local RTD #5 Name	32	127	1	-	F1	'R'
↓	↓						
1823	8th Character of Local RTD #5 Name	32	127	1	-	F1	" "
...	Reserved						
LOCAL RTD #6							
1830	Local RTD #6 Application	0	4	1	-	F121	0
1831	Local RTD #6 High Alarm	0	2	1	-	F115	0
1832	Local RTD #6 High Alarm Relays	0	7	1	-	F113	2
1833	Local RTD #6 High Alarm Level	1	200	1	°C	F1	130
1834	Local RTD #6 Alarm	0	2	1	-	F115	0
1835	Local RTD #6 Alarm Relays	0	7	1	-	F113	1
1836	Local RTD #6 Alarm Level	1	200	1	°C	F1	130
1837	Record RTD #6 Alarms as Events	0	1	1	-	F103	0
1838	Local RTD #6 Trip	0	2	1	-	F115	0
1839	Enable RTD #6 Trip Voting	0	13	1	-	F122	1
183A	Local RTD #6 Trip Relays	0	7	1	-	F111	1
183B	Local RTD #6 Trip Level	1	200	1	°C	F1	130
183C	Local RTD #6 RTD Type	0	3	1	-	F120	0

Table 8–1: MEMORY MAP (Sheet 8 of 11)

ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
1840	First Character of Local RTD #6 Name	32	127	1	-	F1	'R'
↓	↓						
1843	8th Character of Local RTD #6 Name	32	127	1	-	F1	" "
...	Reserved						
LOCAL RTD #7							
1850	Local RTD #7 Application	0	4	1	-	F121	0
1851	Local RTD #7 High Alarm	0	2	1	-	F115	0
1852	Local RTD #7 High Alarm Relays	0	7	1	-	F113	2
1853	Local RTD #7 High Alarm Level	1	200	1	°C	F1	130
1854	Local RTD #7 Alarm	0	2	1	-	F115	0
1855	Local RTD #7 Alarm Relays	0	7	1	-	F113	1
1856	Local RTD #7 Alarm Level	1	200	1	°C	F1	130
1857	Record RTD #7 Alarms as Events	0	1	1	-	F103	0
1858	Local RTD #7 Trip	0	2	1	-	F115	0
1859	Enable RTD #7 Trip Voting	0	13	1	-	F122	1
185A	Local RTD #7 Trip Relays	0	7	1	-	F111	1
185B	Local RTD #7 Trip Level	1	200	1	°C	F1	130
185C	Local RTD #7 RTD Type	0	3	1	-	F120	0
1860	First Character of Local RTD #7 Name	32	127	1	-	F1	'R'
↓	↓						
1863	8th Character of Local RTD #7 Name	32	127	1	-	F1	" "
1864	Reserved						
LOCAL RTD #8							
1870	Local RTD #8 Application	0	4	1	-	F121	0
1871	Local RTD #8 High Alarm	0	2	1	-	F115	0
1872	Local RTD #8 High Alarm Relays	0	7	1	-	F113	2
1873	Local RTD #8 High Alarm Level	1	200	1	°C	F1	130
1874	Local RTD #8 Alarm	0	2	1	-	F115	0
1875	Local RTD #8 Alarm Relays	0	7	1	-	F113	1
1876	Local RTD #8 Alarm Level	1	200	1	°C	F1	130
1877	Record RTD #8 Alarms as Events	0	1	1	-	F103	0
1878	Local RTD #8 Trip	0	2	1	-	F115	0
1879	Enable RTD #8 Trip Voting	0	13	1	-	F122	1
187A	Local RTD #8 Trip Relays	0	7	1	-	F111	1
187B	Local RTD #8 Trip Level	1	200	1	°C	F1	130
187C	Local RTD #8 RTD Type	0	3	1	-	F120	0
1880	First Character of Local RTD #8 Name	32	127	1	-	F1	'R'
↓	↓						
1883	8th Character of Local RTD #8 Name	32	127	1	-	F1	" "
1884	Reserved						
LOCAL RTD #9							
1890	Local RTD #9 Application	0	4	1	-	F121	0
1891	Local RTD #9 High Alarm	0	2	1	-	F115	0
1892	Local RTD #9 High Alarm Relays	0	7	1	-	F113	2
1893	Local RTD #9 High Alarm Level	1	200	1	°C	F1	130
1894	Local RTD #9 Alarm	0	2	1	-	F115	0
1895	Local RTD #9 Alarm Relays	0	7	1	-	F113	1
1896	Local RTD #9 Alarm Level	1	200	1	°C	F1	130
1897	Record RTD #9 Alarms as Events	0	1	1	-	F103	0
1898	Local RTD #9 Trip	0	2	1	-	F115	0
1899	Enable RTD #9 Trip Voting	0	13	1	-	F122	1
189A	Local RTD #9 Trip Relays	0	7	1	-	F111	1
189B	Local RTD #9 Trip Level	1	200	1	°C	F1	130
189C	Local RTD #9 RTD Type	0	3	1	-	F120	0
18A0	First Character of Local RTD #9 Name	32	127	1	-	F1	'R'
↓	↓						
18A3	8th Character of Local RTD #9 Name	32	127	1	-	F1	" "
18A4	Reserved						

Table 8–1: MEMORY MAP (Sheet 9 of 11)

ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
LOCAL RTD #10							
18B0	Local RTD #10 Application	0	4	1	-	F121	0
18B1	Local RTD #10 High Alarm	0	2	1	-	F115	0
18B2	Local RTD #10 High Alarm Relays	0	7	1	-	F113	2
18B3	Local RTD #10 High Alarm Level	1	200	1	°C	F1	130
18B4	Local RTD #10 Alarm	0	2	1	-	F115	0
18B5	Local RTD #10 Alarm Relays	0	7	1	-	F113	1
18B6	Local RTD #10 Alarm Level	1	200	1	°C	F1	130
18B7	Record RTD #10 Alarms as Events	0	1	1	-	F103	0
18B8	Local RTD #10 Trip	0	2	1	-	F115	0
18B9	Enable RTD #10 Trip Voting	0	13	1	-	F122	1
18BA	Local RTD #10 Trip Relays	0	7	1	-	F111	1
18BB	Local RTD #10 Trip Level	1	200	1	°C	F1	130
18BC	Local RTD #10 RTD Type	0	3	1	-	F120	0
18C0	First Character of Local RTD #10 Name	32	127	1	-	F1	'R'
↓	↓						
18C3	8th Character of RTD #10 Name	32	127	1	-	F1	" "
...	Reserved						
LOCAL RTD #11							
18D0	Local RTD #11 Application	0	4	1	-	F121	0
18D1	Local RTD #11 High Alarm	0	2	1	-	F115	0
18D2	Local RTD #11 High Alarm Relays	0	7	1	-	F113	2
18D3	Local RTD #11 High Alarm Level	1	200	1	°C	F1	130
18D4	Local RTD #11 Alarm	0	2	1	-	F115	0
18D5	Local RTD #11 Alarm Relays	0	7	1	-	F113	1
18D6	Local RTD #11 Alarm Level	1	200	1	°C	F1	130
18D7	Record RTD #11 Alarm Events	0	1	1	-	F103	0
18D8	Local RTD #11 Trip	0	2	1	-	F115	0
18D9	Enable RTD #11 Trip Voting	0	13	1	-	F122	1
18DA	Local RTD #11 Trip Relays	0	7	1	-	F111	1
18DB	Local RTD #11 Trip Level	1	200	1	°C	F1	130
18DC	Local RTD #11 RTD Type	0	3	1	-	F120	0
18E0	First Character of Local RTD #11 Name	32	127	1	-	F1	'R'
↓	↓						
18E3	8th Character of Local RTD #11 Name	32	127	1	-	F1	" "
...	Reserved						
LOCAL RTD #12							
18F0	Local RTD #12 Application	0	4	1	-	F121	0
18F1	Local RTD #12 High Alarm	0	2	1	-	F115	0
18F2	Local RTD #12 High Alarm Relays	0	7	1	-	F113	2
18F3	Local RTD #12 High Alarm Level	1	200	1	°C	F1	130
18F4	Local RTD #12 Alarm	0	2	1	-	F115	0
18F5	Local RTD #12 Alarm Relays	0	7	1	-	F113	1
18F6	Local RTD #12 Alarm Level	1	200	1	°C	F1	130
18F7	Record RTD #12 Alarms as Events	0	1	1	-	F103	0
18F8	Local RTD #12 Trip	0	2	1	-	F115	0
18F9	Enable RTD #12 Trip Voting	0	13	1	-	F122	1
18FA	Local RTD #12 Trip Relays	0	7	1	-	F111	1
18FB	Local RTD #12 Trip Level	1	200	1	°C	F1	130
18FC	Local RTD #12 RTD Type	0	3	1	-	F120	0
1900	First Character of Local RTD #12 Name	32	127	1	-	F1	'R'
↓	↓						
1903	8th Character of Local RTD #12 Name	32	127	1	-	F1	" "
...	Reserved						
OPEN RTD ALARM							
1B20	Open RTD Alarm	0	2	1	-	F115	0
1B21	Assign Alarm Relays	0	7	1	-	F113	1
1B22	Open RTD Alarm Events	0	1	1	-	F103	0

Table 8–1: MEMORY MAP (Sheet 10 of 11)

ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
SHORT/LOW TEMPERATURE RTD ALARM							
1B23	Short / Low Temp RTD Alarm	0	2	1	-	F115	0
1B24	Assign Alarm Relays	0	7	1	-	F113	1
1B25	Short / Low Temp Alarm Events	0	1	1	-	F103	0
...	Reserved	-	-	-	-	-	-
TRIP COUNTER							
1C80	Trip Counter Alarm	0	2	1	-	F115	0
1C81	Assign Alarm Relays	0	7	1	-	F113	1
1C82	Alarm Pickup Level	0	50000	1	-	F1	25
1C83	Trip Counter Alarm Events	0	1	1	-	F103	0
...	Reserved						
ANALOG OUTPUTS							
1D40	Enable Analog Output 1	0	1	1	-	F103	0
1D41	Assign Analog Output 1 Output Range	0	2	1	-	F26	0
1D42	Assign Analog Output 1 Parameter	0	111	1	-	F127	0
1D43	Analog Output 1 Minimum	TBD	TBD	1	-	F1	0
1D44	Analog Output 1 Maximum	TBD	TBD	1	-	F1	0
1D45	Enable Analog Output 2	0	1	1	-	F103	0
1D46	Assign Analog Output 2 Output Range	0	2	1	-	F26	0
1D47	Assign Analog Output 2 Parameter	0	111	1	-	F127	0
1D48	Analog Output 2 Minimum	TBD	TBD	1	-	F1	0
1D49	Analog Output 2 Maximum	TBD	TBD	1	-	F1	0
1D4A	Enable Analog Output 3	0	1	1	-	F103	0
1D4B	Assign Analog Output 3 Output Range	0	2	1	-	F26	0
1D4C	Assign Analog Output 3 Parameter	0	111	1	-	F127	0
1D4D	Analog Output 3 Minimum	TBD	TBD	1	-	F1	0
1D4E	Analog Output 3 Maximum	TBD	TBD	1	-	F1	0
1D4F	Enable Analog Output 4	0	1	1	-	F103	0
1D50	Assign Analog Output 4 Output Range	0	2	1	-	F26	0
1D51	Assign Analog Output 4 Parameter	0	111	1	-	F127	0
1D52	Analog Output 4 Minimum	TBD	TBD	1	-	F1	0
1D53	Analog Output 4 Maximum	TBD	TBD	1	-	F1	0
...	Reserved						
TEST OUTPUT RELAYS (0 = continuous)							
1F80	Force Trip Relay	0	2	1	-	F150	0
1F81	Force Trip Relay Duration	1	300	1	s	F1	0
1F82	Force AUX1 Relay	0	2	1	-	F150	0
1F83	Force AUX1 Relay Duration	1	300	1	s	F1	0
1F84	Force AUX2 Relay	0	2	1	-	F150	0
1F85	Force AUX2 Relay Duration	1	300	1	s	F1	0
1F86	Force Alarm Relay	0	2	1	-	F150	0
1F87	Force Alarm Relay Range	1	300	1	s	F1	0
...	Reserved						
TEST ANALOG OUTPUTS							
1F90	Force Analog Outputs	0	1	1	-	F126	0
1F91	Analog Output 1 Forced Value	0	100	1	% range	F1	0
1F92	Analog Output 2 Forced Value	0	100	1	% range	F1	0
1F93	Analog Output 3 Forced Value	0	100	1	% range	F1	0
1F94	Analog Output 4 Forced Value	0	100	1	% range	F1	0
...	Reserved						
EVENT RECORDER / TRACE MEMORY (ADDRESSES 3000 TO 3FFF)							
EVENT RECORDER							
3000	Event Recorder Last Reset (2 words)	N/A	N/A	N/A	N/A	F18	N/A
3002	Total Number of Events Since Last Clear	0	65535	1	N/A	F1	0
3003	Event Record Selector (1=oldest, 40=newest)	1	40	1	N/A	F1	1
3004	Cause of Event	0	40	1	-	F134	0
3005	Time of Event (2 words)	N/A	N/A	N/A	N/A	F19	N/A
3007	Date of Event (2 words)	N/A	N/A	N/A	N/A	F18	N/A
3009	Reserved	-	-	-	-	-	-

Table 8–1: MEMORY MAP (Sheet 11 of 11)

ADDR (hex)	DESCRIPTION	MIN.	MAX.	STEP VALUE	UNITS	FORMAT CODE	FACTORY DEFAULT
3012	Event Hottest Stator RTD	0	12	1	-	F1	0
3013	Event Temperature of Hottest Stator RTD	-40	200	1	°C	F4	0
...	Reserved	-	-	-	-	-	-

Table 8–2: MEMORY MAP DATA FORMATS (Sheet 1 of 5)

CODE	TYPE	DEFINITION
F1	16 bits	**UNSIGNED VALUE** Example: 1234 stored as 1234
F2	16 bits	**UNSIGNED VALUE, 1 DECIMAL PLACE** Example: 123.4 stored as 1234
F3	16 bits	**UNSIGNED VALUE, 2 DECIMAL PLACES** Example: 12.34 stored as 1234
F4	16 bits	**2's COMPLEMENT SIGNED VALUE** Example: -1234 stored as -1234 (i.e. 64302)
F5	16 bits	**2's COMPLEMENT SIGNED VALUE, 1 DECIMAL PLACES** Example: -123.4 stored as -1234 (i.e. 64302)
F6	16 bits	**2's COMPLEMENT SIGNED VALUE, 2 DECIMAL PLACES** Example: -12.34 stored as -1234 (i.e. 64302)
F7	16 bits	**2's COMPLEMENT SIGNED VALUE, 3 DECIMAL PLACES** Example: -1.234 stored as -1234 (i.e. 64302)
F8	16 bits	**2's COMPLEMENT SIGNED VALUE, 4 DECIMAL PLACES** Example: -0.1234 stored as -1234 (i.e. 64302)
F15	16 bits	**HARDWARE REVISION**
	0000 0000 0000 0001	1 = A
	0000 0000 0000 0010	2 = B
	↓	↓
	0000 0000 0001 1010	26 = Z
F16	16 bits	**SOFTWARE REVISION**
	1111 1111 xxxx xxxx	Major Revision Number, 0 to 9 in steps of 1
	xxxx xxxx 1111 1111	Minor Revision Number (two BCD digits), 00 to 99 in steps of 1 Example: Revision 2.30 stored as 0230 hex
F18	32 bits	**DATE (MM/DD/YYYY)** Example: Feb. 20, 1995 stored as 34867142 (i.e. 1st word: 0214, 2nd word 07C6)
	1st byte	Month (1 to 12)
	2nd byte	Day (1 to 31)
	3rd and 4th byte	Year (1998 to 2094)
F19	32 bits	**TIME (HH:MM:SS:hh)** Example: 2:05pm stored as 235208704 (i.e. 1st word: 0E05, 2nd word 0000)
	1st byte	Hours (0 to 23)
	2nd byte	Minutes (0 to 59)
	3rd byte	Seconds (0 to 59)
	4th byte	Hundreds of seconds (0 to 99) - Not used by 369
F22	16 bits	**TWO 8-BIT CHARACTERS PACKED INTO 16-BIT UNSIGNED** Example: String "AB" stored as 4142 hex.
	MSB	First Character
	LSB	Second Character
F26	16 Bits	**ANALOG OUTPUT SELECTION**
	0	0 - 1mA
	1	0 - 20 mA
	2	4 - 20 mA
F31	16 Bits	**COMMAND FUNCTION CODES**
	0	Not in use
	1	Reset RRTD
	...	Reserved
	6	Clear Trip Counters
	7	Clear Last Trip Date
	...	Reserved
	10	Clear RTD Maximums
F100	Unsigned 16 bit integer	**TEMPERATURE DISPLAY UNITS**
	0	Celsius
	1	Fahrenheit

Table 8–2: MEMORY MAP DATA FORMATS (Sheet 2 of 5)

CODE	TYPE	DEFINITION
F101	Unsigned 16 bit integer	**RS485 BAUD RATE**
	0	1200 baud
	1	2400 baud
	2	4800 baud
	3	9600 baud
	4	19200 baud
F102	Unsigned 16 bit integer	**RS485 PARITY**
	0	None
	1	Odd
	2	Even
F103	Unsigned 16 bit integer	**OFF/ON OR NO/YES SELECTION**
	0	Off / No
	1	On / Yes
F111	Unsigned 16 bit integer	**TRIP RELAYS**
	0	none
	1	Trip
	2	Aux1
	3	Aux2
	4	Trip & Aux1
	5	Trip & Aux2
	6	Aux1 & Aux2
	7	Trip & Aux1 & Aux2
F112	Unsigned 16 bit integer	**NOT DEFINED**
	0	
	1	
F113	Unsigned 16 bit integer	**ALARM RELAYS**
	0	None
	1	Alarm
	2	Aux1
	3	Aux2
	4	Alarm & Aux1
	5	Alarm & Aux2
	6	Aux1 & Aux2
	7	Alarm & Aux1 & Aux2
F114	Unsigned 16 bit integer	**COUNTER TYPE**
	0	Increment
	1	Decrement
F115	Unsigned 16 bit integer	**ALARM/TRIP TYPE SELECTION**
	0	Off
	1	Latched
	2	Unlatched
F116	Unsigned 16 bit integer	**SWITCH TYPE**
	0	Normally Open
	1	Normally Closed
F119	Unsigned 16 bit integer	**BACKUP RELAYS**
	0	None
	1	Aux 1
	2	Aux1 & Aux2
	3	Aux2
F120	Unsigned 16 bit integer	**RTD TYPE**
	0	100 Ohm Platinum
	1	120 Ohm Nickel
	2	100 Ohm Nickel
	3	10 Ohm Copper

Table 8–2: MEMORY MAP DATA FORMATS (Sheet 3 of 5)

CODE	TYPE	DEFINITION
F121	Unsigned 16 bit integer	**RTD APPLICATION**
	0	None
	1	Stator
	2	Bearing
	3	Ambient
	4	Other
F122	Unsigned 16 bit integer	**LOCAL/REMOTE RTD VOTING SELECTION**
	0	Off
	1	RTD #1
	2	RTD #2
	3	RTD #3
	4	RTD #4
	5	RTD #5
	6	RTD #6
	7	RTD #7
	8	RTD #8
	9	RTD #9
	10	RTD #10
	11	RTD #11
	12	RTD #12
	13	All Stator
F123	Unsigned 16 bit integer	**ALARM STATUS**
	0	Off
	1	Not Active
	2	Timing Out
	3	Active
	4	Latched
F127	Unsigned 16 bit integer	**ANALOG OUTPUT PARAMETER SELECTION**
	0 to 11	Reserved
	12	Hottest Stator RTD
	13	Local RTD #1
	14	Local RTD #2
	15	Local RTD #3
	16	Local RTD #4
	17	Local RTD #5
	18	Local RTD #6
	19	Local RTD #7
	20	Local RTD #8
	21	Local RTD #9
	22	Local RTD #10
	23	Local RTD #11
	24	Local RTD #12
F130	Unsigned 16 bit integer	**DIGITAL INPUT PICKUP TYPE**
	0	Over
	1	Under
F131	Unsigned 16 bit integer	**INPUT SWITCH STATUS**
	0	Open
	1	Closed
F134	Unsigned 16 bit integer	**CAUSE OF EVENT**
	0	No Event
	1 to 4	Resolved
	5	Digital Input 6 Trip
	6	Digital Input 2 Trip
	7	Digital Input 5 Trip

Table 8–2: MEMORY MAP DATA FORMATS (Sheet 4 of 5)

CODE	TYPE	DEFINITION
F134 ctd.	8	Digital Input 4 Trip
	9	Digital Input 1 Trip
	10	Digital Input 3 Trip
	11 to 40	Reserved
	41	Local RTD1 Trip
	42	Local RTD2 Trip
	43	Local RTD3 Trip
	44	Local RTD4 Trip
	45	Local RTD5 Trip
	46	Local RTD6 Trip
	47	Local RTD7 Trip
	48	Local RTD8 Trip
	49	Local RTD9 Trip
	50	Local RTD10 Trip
	51	Local RTD11 Trip
	52	Local RTD12 Trip
	53 to 66	Reserved
	67	Digital Input 6 Alarm
	68	Digital Input 2 Alarm
	69	Digital Input 5 Alarm
	70	Digital Input 4 Alarm
	71	Digital Input 1 Alarm
	72	Digital Input 3 Alarm
	73 to 91	Reserved
	92	Local RTD1 Alarm
	93	Local RTD2 Alarm
	94	Local RTD3 Alarm
	95	Local RTD4 Alarm
	96	Local RTD5 Alarm
	97	Local RTD6 Alarm
	98	Local RTD7 Alarm
	99	Local RTD8 Alarm
	100	Local RTD9 Alarm
	101	Local RTD10 Alarm
	102	Local RTD11 Alarm
	103	Local RTD12 Alarm
	104	Local RTD1 Hi Alarm
	105	Local RTD2 Hi Alarm
	106	Local RTD3 Hi Alarm
	107	Local RTD4 Hi Alarm
	108	Local RTD5 Hi Alarm
	109	Local RTD6 Hi Alarm
	110	Local RTD7 Hi Alarm
	111	Local RTD8 Hi Alarm
	112	Local RTD9 Hi Alarm
	113	Local RTD10 Hi Alarm
	114	RTD11 Hi Alarm
	115	RTD12 Hi Alarm
	116 to 141	Reserved
	142	Open RTD Alarm
	143	Lost RRTD Comm Alarm

Table 8–2: MEMORY MAP DATA FORMATS (Sheet 5 of 5)

CODE	TYPE	DEFINITION
F134 ctd.	144	Short/Low RTD Alarm
	145	Trip Counter Alarm
	146 to 150	Reserved
	151	Digital Counter Alarm
	152	Service Alarm
	153	Control Power Lost
	154	Control Power App
	155 to 272	Reserved
	273	Power Failure
	274	Software Reset
	275	Clock Failure
	276	A/D Failure
F141	Unsigned 16 bit integer	**OUTPUT RELAY STATUS**
	bit 0	Trip
	bit 1	Alarm
	bit 2	Auxiliary 1
	bit 3	Auxiliary 2
F149	Unsigned 16 Bit Integer	**CHANNEL 3 APPLICATION**
	0	MODBUS
	1	Remote RTD
F150	Unsigned 16 Bit Integer	**OUTPUT RELAY STATUS**
	0	De - Energized
	1	Energized
F151	Unsigned 16 Bit Integer	**CHANNEL TYPE**
	0	RS 485
	1	Fiber Optic
F156	Unsigned 16 Bit Integer	**REMOTE RTD COMMUNICATION STATUS**
	0	Remote RTD Module Communication Lost
	1	Remote RTD Communication on Line
F161	Unsigned 16 Bit Integer	**OUTPUT RELAY FAILSAFE CODE**
	0	Failsafe
	1	Non Failsafe
F162	Unsigned 16 Bit Integer	**ACCESS LEVEL**
	0	Read Only
	1	Read / Write
	2	Factory Service
F163	Unsigned 16 Bit Integer	**RRTD DIGITAL INPUT FUNCTION**
	0	Off
	1	undefined
	2	General Switch
	3	Digital Counter

A

GE MULTILIN RELAY WARRANTY

General Electric Multilin (GE Multilin) warrants each relay it manufactures to be free from defects in material and workmanship under normal use and service for a period of 24 months from date of shipment from factory.

In the event of a failure covered by warranty, GE Multilin will undertake to repair or replace the relay providing the warrantor determined that it is defective and it is returned with all transportation charges prepaid to an authorized service centre or the factory. Repairs or replacement under warranty will be made without charge.

Warranty shall not apply to any relay which has been subject to misuse, negligence, accident, incorrect installation or use not in accordance with instructions nor any unit that has been altered outside a GE Multilin authorized factory outlet.

GE Multilin is not liable for special, indirect or consequential damages or for loss of profit or for expenses sustained as a result of a relay malfunction, incorrect application or adjustment.

For complete text of Warranty (including limitations and disclaimers), refer to GE Multilin Standard Conditions of Sale.

A

Numerics

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