



## Model RM-2000-RTDW

Remote Monitor for the 777 Series Electronic Overload Relays and remote RTD modules



UG-RM2000-RTDW-C

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## **FEATURES**

The RM-2000-RTDW remote display monitors temperatures and electrical power conditions and can be configured to control SymCom's 777 Series via an RS-485 Modbus network. Two form C output relays are available for an RTD alarm and a warning alarm. Alarm and trip levels can be set for each RTD to activate the RTD alarm and deactivate the 777 output relay.

In addition, the RM-2000-RTDW has two inputs: one to connect to a ground-fault module and the other for connection to a remote reset button.

A second communication port allows monitoring and control of up to 99 RM-2000-RTDW devices from a personal computer (PC) with SymCom's Solutions software, or a PLC, DCS, or SCADA system. The RM-2000-RTDW is environmentally protected and can easily be mounted on the front of a panel or MCC.

The RM-2000-RTDW includes time logging and historical data tracking.

## **INFORMATION DISPLAYED**

The RM-2000-RTDW can display all of the information the 777 Series displays as well as information that the 777 Series maintains but does not display.

The RM-2000-RTDW displays the following real-time motor information:

- Line currents, average current and current unbalance
- Line-to-line voltages, average voltage and voltage unbalance
- Remaining restart delay times
- Current to ground
- Total motor run-time (reset capable)
- Energy consumption (KWhs) (reset capable)
- Total number of motor starts and trips (reset capable)
- Power factor
- Power draw (kW)
- kVARs
- 8 RTD temperatures
- Warning settings
- Pending faults

The RM-2000-RTDW displays the following fault history information:

- Time and date of last four faults, with voltage and current at time of trip
- Time-stamped event log
- Minimum time between any two starts with time and date
- Run-time since last start (reset capable)
- Time of last motor start

## **INSTALLATION PROCEDURE**

**MOUNTING OPTIONS** (for flat surface mounting on NEMA 3R, and/or UL Type 12 enclosures)

- **Panel mounting**: a 777 Series is often mounted inside a motor control panel and its display is not visible. The RM-2000-RTDW can be mounted on the outside of the panel, allowing all of the information from the 777 Series to be displayed without opening the control panel.
- **Remote mounting**: the RM-2000-RTDW communicates with the 777 Series by an RS-485 cable which can be up to 4000 feet long. This allows the RM-2000-RTDW to remotely monitor a 777 Series.

## **INSTALLATION**

1. Attach the template drawing to the panel where the RM-2000-RTDW is to be mounted.
2. Take caution when drilling the holes to mount the RM-2000-RTDW. Use an 11/64" drill bit for the four corner mounting screws. Drill a 1 15/16" – 2 3/16" hole, or a 2" knock out, for the terminals to protrude through to the inside of the panel.
3. Verify the gasket is in place on the back of the RM-2000-RTDW. Attach the RM-2000-RTDW to the panel using the four screws provided.
4. Run the appropriate wires to the back of the RM-2000-RTDW and terminate the wires in the provided screw-type, depluggable connectors; see the wiring diagram on the following page. This should include at least 115VAC control power, one set of communication wires to the 777, and ground wire to case ground on the panel.

When connecting a Renu FIOA RTD module, terminal **A** of the RTD module is connected to **A1** of the RM-2000-RTDW – **B** is connected to **B1**.

NOTE: When connecting a Benshaw remote RTD module, terminal A of the RTD module must be connected to B1 of the RM-2000-RTDW – B must be connected to A1.

5. It is important to have the A phase of the breaker connected to L1 on the 777, B phase to L2 and C to L3. Equally important, is to have the A phase conductor through the A phase hole, B through the B phase hole, and C through the C phase hole of the 777 Series for proper power calculations.
6. The 777 Series, when used with the RM-2000-RTDW, should be connected according to the wiring diagrams found in the Installation Instructions for the appropriate 777 Series product.
7. A jumper or switch may be placed across K1 and K2 to enable programming lock.<sup>1</sup>

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<sup>1</sup> If desired, a key-switch can be installed in place of the jumper to allow only authorized personnel to make system/setting changes.

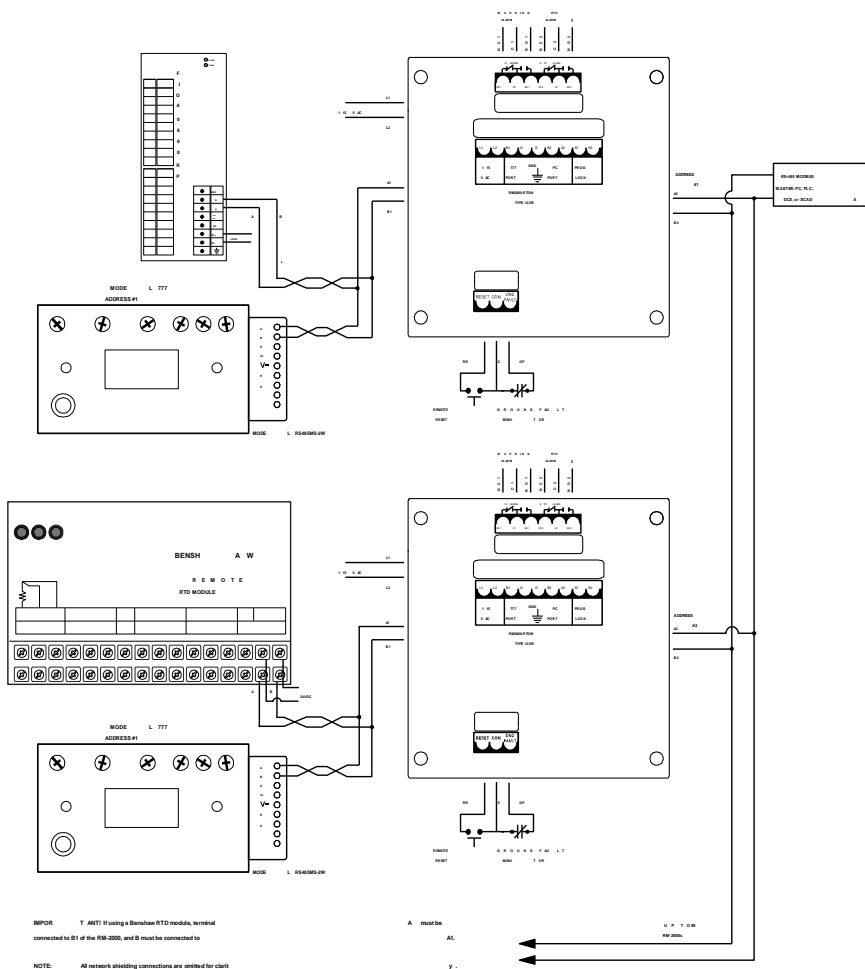


Figure 1: RM-2000-RTDW Wiring Diagram

## CONNECTIONS - NEW INSTALLATION

A SymCom Modbus communications module is required to connect the 777 Series to the RS-485 network. A shielded, twisted-pair cable connected to A and B of the module must be connected to Comm Port 1 (A1 & B1) on the back of the RM-2000-RTDW. Refer to the installation instructions or user's guide for the communications module in use.

The RM-2000-RTDW has a second RS-485 port allowing connection to a network host, such as a PLC, DCS, or SCADA system or a PC running Modbus master software such as SymCom's *Solutions*.

The network host is not required. If present, the network host must be connected to Comm Port 2 at the connections labeled **A2** and **B2**. The RM-2000-RTDW can be programmed as device address A01– A99 and up to 99 RM-2000-RTDWs or 777s can exist on the same network. The RM-2000-RTDW's slave and master ports can be programmed for 300, 600, 1200, 2400, 9600, 14400, 19200 or 28800 baud. It can use even, odd or no parity and have 1 or 2 stop bits. The RM-2000-RTDW slave communication parameters must match the communication parameter of the attached overload. The network communication parameters of the RM-2000-RTDW must be the same for all devices connected to the upstream network.

### The RS-485 Network - Terminating Resistors

In Figure 1 there are three RS-485 networks. Each of the two RM-2000-RTDWs with their slave 777 Series and the RTD module form a separate, independent RS-485 network. The third network links the host PC to the two RM-2000-RTDWs. Each independent network may require terminating resistors and may require a ground connection for the shield around the twisted pair cable.

If the length of the twisted pair cable between the RM-2000-RTDW, the 777 Series and the RTD module exceeds 100 feet or if the twisted pair cable is in a noisy environment, 120Ω terminating resistors should be connected at both the RM-2000-RTDW (across A1 and B1) and also at either the 777 Series (across A and B of the RS485MS-2W module) or at the RTD module (across A and B). In addition, the shield of the twisted pair cable should be tied to the RM-2000-RTDW's ground connection (labeled GND) with a single 100Ω resistor. If unsure, install the terminating resistors.

Unlike the port-powered RS-232 to RS-485 converter, the transceiver inside the RM-2000-RTDW is capable of supplying enough current to operate the RS-485 network, even with terminating resistors installed. The RM-2000-RTDW to host is a separate network. It may require separate terminating resistors and ground connection.

## CONNECTIONS - EXISTING NETWORK INSTALLATIONS

If an RM-2000-RTDW is being added to a 777 Series in an existing network, the RM-2000-RTDW's network address must be set to the existing 777 Series's address and the 777 Series's address must be set to match the overload address of the RM-2000-RTDW.

The RM-2000-RTDW will pass read and write requests to the 777 Series, so the RM-2000-RTDW will respond just like the 777 Series except that a slightly longer time out delay may be required. Other than the time out delay, the Modbus Master software will not have to be reprogrammed to communicate with the RM-2000-RTDW, unless the additional information from the RM-2000-RTDW is desired.

## **OPERATION**

RM-2000-RTDW information and functions are divided into five modes:

- REAL TIME
- FAULT HISTORY
- SETPOINT
- SETUP<sup>2</sup>
- CHANGE SETUP (key switch or jumper required)

Press the [MODE] button to switch between these modes. An LED on the left side of the RM-2000-RTDW indicates which mode is selected.

Within any mode, the [SCROLL DOWN] and [SCROLL UP] buttons will change the information being displayed.

Only the SETPOINT and SETUP modes allow setting changes. The CHANGE SETUP LED is lit along with the SETPOINT or SETUP LED when a mode setting is ready to be changed. The [CHANGE SETUP DOWN] and the [CHANGE SETUP UP] buttons decrease and increase the value of a setup option. When the desired value is displayed, press [ENTER] to save the setting.

The [RUN/RESET] and [STOP] buttons will energize and de-energize the 777 Series's control relay provided the Start/Stop option is enabled in the SETUP mode ("EN.START/STOP: YES"). Set the option to "NO" to disable the [RUN/RESET] and [STOP] buttons.

**Note: whether the [RUN/RESET] and [STOP] buttons actually start and stop the motor is dependent on proper motor control connection of the 777 Series and the state of other auxiliary devices in the control circuit.**

## **MODES**

**REAL TIME:** displays all real-time information as well as calculated power factor, power consumption, and total number of starts and trips.

**FAULT HISTORY:** displays detailed information about the last 4 faults that caused the 777 Series to trip. It also displays the last 10 starts; the length of time the motor has been running; and the date, time and length of the minimum time the motor was off.

**SETPOINT:** displays the parameters programmed into the 777 Series. Examples of these parameters would include the overcurrent and undercurrent limits (OC and UC), the current unbalance (CUB) limit, etc., programmed into the 777 Series.

**SETUP:** displays the parameters that affect the operation of the RM-2000-RTDW, such as real-time clock settings (month, day, hour, etc.), the network host communications parameters, the voltage multiplier and others.

**CHANGE SETUP:** allows you to change the parameters that are displayed in the SETUP and SETPOINT modes. **A jumper<sup>3</sup> connected between K1 and K2 on the back of the RM-2000-RTDW is required to enter this mode.** The CHANGE SETUP mode will be skipped when scrolling through the modes if the jumper is not in place.

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<sup>2</sup> When using with the 777-LR-P, select Model "777-P" in setup.

<sup>3</sup> If desired, a key-switch can be installed in place of the jumper to allow only authorized personnel to make system/setting changes.

## LED STATUS INDICATION

Eight LEDs indicate the status of the RM-2000-RTDW:

- Five red LEDs on the left side indicate the display mode.
- The green COMM STATUS LED on the lower right indicates the RM-2000-RTDW is communicating with the 777 Series and the RTD module.
- The green RUN LED on the upper right indicates the motor is drawing current.
- A solid red FAULT LED indicates the 777 Series has tripped on a fault and is either in manual reset mode or the 777 Series is going through restart delay RD2 or RD3. When a fault occurs, the RM-2000-RTDW automatically switches to the FAULT HISTORY mode and displays FAULT 1—the most recent fault. The RM-2000-RTDW will not switch to the FAULT HISTORY mode if it is currently in the CHANGE SETUP mode.
- A blinking red FAULT LED indicates the 777 Series has a pending fault. If the motor is not running, this may be a condition that is preventing the 777 Series from starting, such as high or low voltage. Look at the pending fault screen in the REAL TIME mode to view the existing fault condition.

## COMMUNICATION LOSS

If the RM-2000-RTDW loses communications with either the 777 Series or the RTD module, the green COMM STATUS LED will blink. If communication is lost with both devices, the LED will be off. Any screens with data read from these devices will contain asterisks. For example, the screen showing 3-phase voltages and the average voltage from the 777 will look like:

V	a	b	=				*		V	b	c	=				*
V	a	c	=				*		V	a	v	g	=			*

Things to look for:

- 1) Verify the 777 Series has power on lines L1 and L2.
- 2) Verify the 777 Series is programmed with the correct address.
- 3) Verify the RS-485 cable connects A1 of the RM-2000-RTDW to A of the Model RS-485MS-2W module and B1 to B.
- 4) If using an older communications module, Model **RS485MS**, verify that A is shorted to Y and B is shorted to Z.
- 5) Verify continuity of the RS-485 cable with an ohmmeter (**NOTE: test for continuity only when the RS-485 circuit is de-energized!**).

If the RM-2000-RTDW loses communications with the RTD module, RTD readings in the RT mode will display asterisks and will look like:

R	T	D	#	1	=							*	°	C	
R	T	D	#	2	=							*	°	C	

Things to look for:

- 1) Verify the RTD module has power.
- 2) Verify the Remote RTD Module is programmed with the correct address and the correct baud rate, parity and stop bits.



- 3) If using a Benschaw remote RTD module, verify terminal B of the RTD module is connected to A1 of the RM-2000-RTDW, and A is connected to B1.
- 4) If using a Renu FIOA RTD module, verify terminal A of the RTD module is connected to A1 of the RM-2000-RTDW, and B is connected to B1.

## **NAVIGATION AND SCREEN MODES**

### **REAL-TIME MODE**

The REAL TIME mode displays real-time information as well as calculated power factor and power consumption, and total number of starts and trips. By scrolling through the REAL TIME mode the following screens can be viewed:

#### **Current and Voltage Information**

Displays line-to-line voltages and phase currents.

I	=			5	.	5	0			5	.	6	5			5	.	3	5
V	=			2	3	0				2	3	5				2	2	5	

#### **Line Currents and Average Current**

Displays individual phase currents and average current.

I	a	=	5	.	5	0				I	b	=	5	.	6	5		
I	c	=	5	.	3	5				I	a	v	g	=	5	.	5	0

#### **Line-to-Line Voltages and Average Voltage**

If potential transformers (PTs) are used with the 777 Series, the voltage multiplier ("VOLTAGE MULT" in the SETUP menu) should be programmed with a voltage multiplier equal to the PT ratio. The voltage displayed on the RM-2000-RTDW will be higher than the voltage displayed on the 777 Series, but will be consistent with the actual voltage.

V	a	b	=			2	3	0				V	b	c	=			2	3	5
V	a	c	=			2	2	5				V	a	v	g	=			3	0

#### **Calculated Current and Voltage Unbalance**

Displays calculated current and voltage unbalance.

C	U	R	R	.		U	N	B	A	L	A	N	C	E	=			3	%
V	O	L	T	.		U	N	B	A	L	A	N	C	E	=			2	%

#### **Restart delays RD1, RD2 and RD3**

RD1: power-up and rapid-cycle delay

RD2: restart delay after all faults except undercurrent

RD3: restart delay after an undercurrent fault

**NOTE: This screen displays the time remaining for each restart delay, not the setpoint value programmed into the 777 Series.**

R	E	S	.	D	E	L	A	Y		R	D	2	=					0	M
R	D	1	=				0	S		R	D	3	=					0	M

### Ground Fault Current

For a motor, this value would likely represent the current leaking through the insulation of one or more phases.

G	R	O	U	N	D		F	A	U	L	T		C	U	R	R	E	N	T
							0	.	1	0			A	M	P	S			

### Accumulated Hours and Energy

The Accumulated Hours is the number of hours the 777 Series has detected current flow and the Energy-kWh (or Energy-MWh) is the calculated energy consumed during these hours. The information displayed is updated every minute.

The Accumulated information is stored in memory and will not be lost if the RM-2000-RTDW loses power. The values can be reset to zero with the CLEAR HISTORY option in the CHANGE SETUP mode.

A	C	C	.		H	O	U	R	S	=								0	.	1
E	N	E	R	G	Y	-	K	W	H	=								3	.	0

### Number of Starts and Trips

Values can be reset to zero by the CLEAR HISTORY option in the CHANGE SETUP mode.

N	O	.		S	T	A	R	T	S	=										5
N	O	.		T	R	I	P	S	=											2

### Average Voltage, Current and Power Factor

If connected to a 777 P2 or a Model 601, be sure to set the Model to 777-P2 or 601 in the CHANGE SETUP mode. This allows the Frequency information to be displayed on this screen instead of Average Voltage and Average Current.

V	A	V	=			2	3	0		I	A	V	G	=			5	.	5	0
P	O	W	E	R		F	A	C	T	O	R	=					0	.	9	6

### Power and KVARs

Displays consumed motor power in kW and reactive power in KVARs.

P	O	W	E	R	(	K	W	)	=								1	.	2	1
K	V	A	R	S				=									0	.	6	4

### (777-P series) Thermal Capacity and Time-To-Trip

Displays the estimated Thermal Capacity, expressed as a Percentage, based on Trip Class. The OC TimeToTrip is the estimated trip time assuming that the over current level remains constant.

T	H	E	R	M		C	A	P	A	C	I	T	Y	:				1	0	0
O	C		T	i	m	e	T	o	T	r	i	p	:							0

### (777-P series) Status bits

Displays the 777-P Series Status bits, expressed as a hexadecimal number. The second line is a brief interpretation of the bits.

S	T	A	T	U	S		B	I	T	S	:						0	x	8	0	0	0
R	i	y																				

### (777-P series) Trip Reason bits

Displays the 777-P Series Trip Reason register, expressed as a hexadecimal number. The second line is a brief interpretation of the bits.

T	R	I	P		R	E	A	S	O	N	:				0	x	0	0	0	0
	C	I	R																	

### (777-P series) Warning Status bits

Displays the 777-P Series Warning Status register expressed as a hexadecimal number. The second line is a brief interpretation of the bits. See the 777-P2 programming guide for further information on the warning levels and trip delays.

**NOTE: These warning levels are independent of the RM2000-RTDW Warning Information displayed below.**

W	A	R	N	I	N	G		S	T	A	T	:				0	x	0	0	0	0
	C	I	R																		

### RTD Inputs

Displays the temperature measurements from the 8 RTDs.

R	T	D		#	1	=											7	0	°	C	
R	T	D		#	2	=											1	0	0	°	C

### Input Status Bits

Displays the status of the RM-2000-RTDW input channels.

This screen is only visible if the I/O Screens are set to ON (CHANGE SETUP mode).

I	n	p	u	T		B	i	t	s	=	7	6	5	4	3	2	1	0	
						S	T	a	t	u	s	=	0	0	0	0	0	0	0

### RM2000-RTDW Warning Information

The warning screen displays each of the present warning conditions based on the WarnLevels set in the RM2000-RTDW's SETUP mode. If no warning conditions exist, "NONE" will be displayed. If any warning condition is present, the WARNING ALARM relay is energized.

**NOTE: These warning levels are independent of the 777-P2 series Warning Status bits displayed above.**

		R	M	-	R	T	D		W	A	R	N	I	N	G	S		
O	C		U	C		V	U	B		C	U	B		H	V		L	V

## Pending Fault Information

The Pending Fault screen will display up to three pending faults the 777 Series has sensed. The RM-2000-RTDW's FAULT LED will blink anytime a pending fault condition exists. If the 777 Series is in a de-energized state, the pending fault identifies present conditions that will prevent the 777 Series from starting. The RM-2000-RTDW uses the following codes to represent the faults:

<u>Fault Code</u>	<u>Fault Description</u>
OC	Overcurrent
I SP	Single-phase current
V SP	Single-phase voltage
CUB	Current unbalance
RP	Reverse phase
UC	Undercurrent
VUB	Voltage unbalance
HV	High voltage
LV	Low voltage
GF	Ground fault
HPr	High Power
LPr	Low Power

				P	E	N	D	I	N	G		F	A	U	L	T			
								N	O	N	E								

## FAULT HISTORY MODE

### Fault Information

The RM-2000-RTDW will store detailed information about the last 4 faults. The fault information may be cleared by the CLEAR FAULTS option in the CHANGE SETUP mode.

**NOTE: When a fault occurs the RM-2000-RTDW will jump to the FAULT HISTORY mode and display the Fault 1 screen. To return to the previous mode, press ENTER.**

### Fault Description, Date & Time

Displays faults. Fault #1 is the most recent, fault #4 is the oldest.

F	A	U	L	T		1		[	C	U	R	R		U	N	B	A	L	]
2	0	0	7	/	0	3	/	1	4		0	2	:	5	5	:	2	6	P

### Fault Currents

Displays phase current measurements just before the fault.

F	A	U	L	T		1			C	U	R	R	E	N	T	S	=		
		5	.	5	0				5	.	6	5				5	.	3	5

### Fault Voltages

Displays voltage measurements just before the fault.

F	A	U	L	T		1			V	O	L	T	A	G	E	S	=		
		2	3	0					2	3	5					2	2	5	

### Fault Current Unbalance and Average Current

Displays status reported just before the fault.

F	A	U	L	T	1	C	.	U	N	B	A	L	=		3	%		
A	V	E	R	A	G	E		C	U	R	R	.	=		5	.	5	0

### Fault Voltage Unbalance and Average Voltage

Displays status reported just before the fault.

F	A	U	L	T	1	V	.	U	N	B	A	L	=		3	%	
A	V	E	R	A	G	E		V	O	L	T	.	=		2	3	0

### Fault Ground Fault Current

Displays status reported just before the fault.

F	A	U	L	T	1	[	C	U	R	R		U	N	B	A	L	]
G	R	O	U	N	D		F	A	U	L	T	=		1	.	2	A

### Event Information

The RM-2000-RTDW will store the time of the last 10 events: motor starts, motor stops, RM-2000-RTDW power on, RM-2000-RTDW power loss, communication on, communication loss. Event information can be cleared by the CLEAR EVENTS option in the CHANGE SETUP mode.

### Event Description Date & Time

Displays last ten events. Event #1 is the most recent and event #10 is the oldest.

E	V	E	N	T		1	:		M	T	R		S	T	A	R	T		
2	0	0	7	/	0	3	/	1	5		0	7	:	5	7	:	2	3	P

### Last Start

Displays date and time of the last motor start.

L	A	S	T		S	T	A	R	T	:									
2	0	0	7	/	0	3	/	1	5		0	7	:	5	7	:	2	3	P

### Run Time

Displays the length of time between the last motor start and stop.

R	U	N		T	I	M	E	:							1		D	A		
2	0			H	R	S		2	8		M	I	N		5	4		S	E	C

### Date of Minimum Off Time

Displays the date and time of the start following the Minimum Off Time.

D	A	T	E		O	F		M	I	N		O	F		T	I	M	E	
2	0	0	7	/	0	3	/	1	1		1	0	:	2	5	:	5	3	P

### Minimum Off Time

Displays the minimum length of time the motor was off.

Very short times may signify a motor was not allowed to cool down before restarting, indicating a programming error or operator override.

**NOTE: The Last Start, Run Time, Date of Minimum Off Time and Minimum Off time screens can be cleared by the CLEAR MIN OFF option in the CHANGE SETUP mode.**

M	I	N		O	F	F		T	I	M	E	:					
							1		M	I	N		2		S	E	C

### Minimum Time Before the Next Start

Based on the Minimum Time Between Starts setting (in the SETUP mode), this screen displays the time remaining before the motor can be started again.

M	I	N		T	I	M	E		B	E	F	O	R	E		N	E	X	T
S	T	A	R	T	:										0		S	E	C

## CHANGE SETUP MODE

The CHANGE SETUP<sup>4</sup> mode allows changes to be made to the SETPOINT and SETUP information. To change SETPOINT parameters, press the MODE button until both SETPOINT and CHANGE SETUP LEDs illuminate. To change SETUP parameters, press the MODE button until SETUP and CHANGE SETUP LEDs illuminate.

In the CHANGE SETUP mode, a ">" and "<" will indicate the selected parameter. Use the [SCROLL UP] and [SCROLL DOWN] buttons to move through the parameters. To change the value or a parameter, press the CHANGE SETUP [UP] and [DOWN] buttons. When a value is changed, an asterisk will appear. To save the displayed value, press [ENTER].

## SETPOINT MODE

The SETPOINT mode displays the parameters that are programmed into the 777 Series. Each setting can be viewed and changed using the RM-2000-RTDW, without interrupting the 777 Series' control relay.

### Current Limits

Used to view or set the overload and underload limits (OC and UC).

	O	V	E	R			C	U	R	R	.	:			1	6	.	0
	U	N	D	E	R			C	U	R	R	.	:		1	0	.	0

### Voltage Limits

Used to view or set the HV and LV settings.

	O	V	E	R			V	O	L	T	.	:			2	7	2
	U	N	D	E	R			V	O	L	T	.	:		2	0	7

<sup>4</sup> K1 and K2 must be connected or key switch enabled.

### Unbalance Limits

Used to view or set the CUB and VUB settings.

C	U	R	R	.	U	N	B	A	L	;					7	%
V	O	L	T	.	U	N	B	A	L	:					5	%

### Current Multiplier and Ground Fault Limit

Used to view or set the MULT and GF settings.

C	U	R	R	.	M	U	L	T	:							5
G	R	N	D		F	A	U	L	T	:	1	.	2	0		A

### Restart Delays

Used to view or set RD1, RD2, RD3 settings

RD1: rapid-cycle delay

RD2: restart delay after all faults except undercurrent

RD3: restart delay after an undercurrent fault

R	E	S		D	E	L	A	Y		R	D	2	:		3	0	M
R	D	1	:			0	S			R	D	3	:		2	0	M

### Trip Class and Under Current Trip Delay

Used to view or set the TC and UCTD settings.

T	R	I	P		C	L	A	S	S	:						1	0
U	C		T	R	I	P		D	E	L	A	Y	:			5	S

### Number of Restart Attempts after an Undercurrent Fault

Used to view or set #RU setting.

N	U	M	B	E	R		O	F		R	E	S	T	A	R	T	S
O	N		U	N	D	E	R		C	U	R	R	:			0	

### Number of Restart Attempts after any other Fault

Used to view or set #RF setting.

N	U	M	B	E	R		O	F		R	E	S	T	A	R	T	S
O	T	H	E	R		F	A	U	L	T	S	:				0	

### Power Limits

Used to view or set high and low kW settings.

H	I	G	H		K	W	:								0	.	7	5
L	O	W		K	W	:									0	.	5	0

### (777 P series) OC Linear

Used to view or set the OC Linear Trip setting.

O	C		L	i	n	E	a	r	:							O	F	F

**(777 P series) 777-P Multiplier/Divisor –**

Used to view or set multiplier and divisor setpoints for 777-P series<sup>5</sup>

7	7	7	P	M	u	L	t	i	p	l	i	e	r	:					1
7	7	7	P	D	i	V	i	s	o	r	:								1

MULT Setting	Multiplier	Divisor
1	1	1
2	1	2
3	1	3
...	...	...
9	1	9
10	1	10
100	20	5
150	30	5
200	40	5
300	60	5
400	80	5
500	100	5
600	120	5
700	140	5
800	160	5

MULT Setting	Multiplier	Divisor
1	1	1
2	1	2
25	10	2
50	10	1
75	15	1
100	20	1
150	30	1
200	40	1
300	60	1
400	80	1
500	100	1
600	120	1
700	140	1
800	160	1

**Table 1: 777-P Multiplier / Divisor Settings**

**Table 2: 777-LR-P Multiplier / Divisor Settings**

**(777 P series) High Power Trip Delay and KW scaling factor.**

H	i	P	o	w	e	r	T	D	:									5
K	W	S	c	a	l	e	:											2

**Message Builder**

The message builder screen allows you to read and write 777 Series information<sup>6</sup>. Values are displayed in both hexadecimal and decimal numbers. Value and address will be separated into high byte and low byte. In most applications only the low byte will need to be changed.

**Reading:** Select the desired address value in brackets ><. Press Enter. Use change arrows to change command to READ\* and press ENTER. The unit displays COMMAND ACKNOWLEDGE before returning to the message builder screen and displaying the value for the selected address.

**Writing:** Select the desired address value in brackets ><. Press Enter. Use change arrows to change command to WRITE\* and press ENTER. The unit will display the confirmation screen. Use the Change set up arrow to change >NO< to YES\* and press enter. The unit displays COMMAND ACKNOWLEDGE before returning to the message builder screen and showing the new value for the selected address.

V	a	l	u	e	=	0	0	0	0	h	=					F	F
A	d	d	r	=		0	0	6	5	H		S	K	I	P		

<sup>5</sup> This screen only appears if the RM-2000 is connected to a 777-P series device.

<sup>6</sup> Please refer to SymCom's 777 Programming Guide for more information.



## Command Line

The command line allows you to do several things:

- Turn off/on slave communication watchdog
- Send an off or reset command to the 777 Series
- Lock/unlock network programming—prevents/allows 777 Series parameter setting changes
- Clear run hours
- Clear last fault

S	e	n	d		c	o	m	m	a	n	d	:						
F	A	U	L	T		R	E	L	A	Y						O	F	F

## Model and Software

For a 777-P2 series, the Model field on this screen will be listed as 777 if the RM-2000-RTDW has the Setup Model listed as 777. If the Setup Model is listed as 777-P2, the Model field on this screen will show 778. The 778 signifies that the additional Setpoint and Real Time screens for a 777-P2 will be displayed.

M	o	d	e	l	:											7	7	8
S	o	f	t	w	a	r	e		R	e	v	:		3	3	.	0	4

## SETUP MODE

The SETUP mode displays parameters that affect the operation of the RM-2000-RTDW.

### Real Time Clock

#### Clock Date Settings

Used to view or set real-time clock date settings.

	C	L	O	C	K			Y	E	A	R	:	2	0	1	5		
	M	O	N	T	H	:	0	3				D	A	Y	:	1	4	

#### Clock Time Settings – r

Used to view or set real-time clock time settings.

The time can be displayed in 24 hour values by changing (AM/PM) to (24HR).

	H	O	U	R	:	0	1	P			(	A	M	/	P	M	)	
	M	I	N	U	T	E	:	5	9			S	E	C	:	2	6	

## 777 Series Comm Port (Port 1, A1 & B1)

#### 777 Series Port Address

The Overload Address must match the address programmed into the 777 Series.

	O	V	E	R	L	O	A	D		(	P	O	R	T		1	)	
	O	V	R	L	D		A	D	D	R	:				A	0	0	1

#### 777 Port Communication Parameters

To communicate with a standard 777, the RM-2000-RTDW must be set to 9600 baud, even parity, with one stop bit. The RM-2000-RTDW has the ability to be setup to communicate with other overloads with different communication settings.

	O	V	R	L	O	A	D		B	A	U	D	:		9	6	0	0	
	P	A	R	I	T	Y	:	E					S	T	O	P	:	1	

## Network Comm Port (Port 2, A2 & B2)

### Network Port Address

The host network allows communication between an RM-2000-RTDW and a PC with SymCom's *Solutions* software, or a PLC, DCS, or SCADA system. Up to 99 RM-2000-RTDWs can exist on this network; thus, the network address can be set from A001–A099.

		N	E	T	W	O	R	K		(	P	O	R	T		2	)		
		N	E	T	W	O	R	K		A	D	D	R	:		A	0	2	6

### Network Port Communication Parameters

The RM-2000-RTDW can communicate on a host network using 300, 600, 1200, 2400, 9600, 14400, 19200 or 28800 baud; even, odd or no parity; and 0, 1 or 2 stop bits.

	N	E	T	W	O	R	K		B	A	U	D	:		9	6	0	0	
	P	A	R	I	T	Y	:	N					S	T	O	P	:	1	

## Network Watchdog

An upstream communication watchdog occurs when no upstream messages are received for 10 seconds. Another watchdog will not occur, and no watchdog actions will be taken again until communication is re-established and then lost again for 10 seconds. The network watchdog can be disabled—meaning there will be no action taken if a network watchdog occurs—or two network watchdog functions can be utilized.

- 1) **Send OFF** – when an upstream communication watchdog occurs, the RM-2000-RTDW will send an off command to the overload, de-energizing the 777's output relay.
- 2) **Send RHWD** – when an upstream communication watchdog occurs, the RM-2000-RTDW will send a remote host watchdog command to the overload.
- 3) **RLY (Relay)** – when an upstream communication watchdog occurs, the RM-2000-RTDW will turn off its relays.

		N	E	t	w	o	r	k		W	a	t	c	h	d	o	g		

## Remote RTD Module Comm Port (Port 1, A1 & B1)

### Type of RTD Module

The choices are:

- 1 = Benschaw SPR100p
- 2 = Renu FIOA-0800-RP

		R	E	M	O	T	E		R	T	D		T	Y	P	E	:	2	
		R	E	n	u		F	I	O	A	-	0	8	0	0	-	R	P	

### Remote RTD Module Address

The RTD Address must match the address selected on the RTD module.

The Benshaw RTD module can be addressed as 16 through 23.

The Renu FIOA RTD module can be addressed as 1 through 64.

The RTD address cannot be set to same address as the 777, which is specified in the OVRD ADDR screen. In addition, if the option for 'Direct Network Access to RTD' is set to YES, this address cannot be set to the NETWORK ADDR.

	R	E	M	O	T	E		R	T	D		(	P	O	R	T		1	)
	R	T	D		A	D	D	R	E	S	S	:						1	6

### Remote RTD Module Communication Parameters

The RM-2000-RTDW can communicate with an RTD module using 300, 600, 1200, 2400, 9600, 14400, 19200 or 28800 baud; even, odd or no parity; and 0, 1 or 2 stop bits. If using a Benshaw Remote RTD module, select 19200 baud, no parity, and 1 stop bit.

If the communication parameters are not the same as the 777 parameters, the RM-2000-RTDW will automatically change the parameters to match the 777 or the RTD module as necessary.

	R	T	D		B	A	U	D	:							1	9	2	0	0	
	P	A	R	I	T	Y	:	N								S	T	O	P	:	1

### Direct Network Access to RTD

This allows a PLC to send a command to the RTD module.

A	L	L	O	W	D	I	R	E	C	T	N	E	T	W	O	R	K
A	C	C	E	S	S	T	O	R	T	D	?				N	O	

### Model and Voltage Multiplier

#### Model Number

The Model Number setting should match the model number of the 777 monitored by the RM-2000-RTDW.

**NOTE: When using with the 777-LR-P, select Model "777-P" in setup. When using any of the 777-P2 series, select Model "777-P2".**

#### Voltage Multiplier

Voltage Multiplier should be set to 1 unless the 777 is powered by potential transformers (PTs). This multiplier is used to scale the voltage readings up to the actual line voltages being monitored.

M	O	D	E	L	:										7	7	7
V	O	L	T	A	G	E	M	U	L	T	:					1	

### 777 Series Power Factor Correction

If the 777 Series-MV (Medium Voltage) is installed with only ONE potential transformer (PT), set this function to YES—the RM-2000-RTDW will adjust the power factor to correct the Power, kVARs, and Energy Usage values. Be sure to check the 777 Series-MV installation instructions to keep the proper relationship between PT and CT connections.

M	O	D	E	L	7	7	7	M	V	W	I	T	H		
O	N	L	Y	1	P	.	T	.	?	:			N	O	

### LCD Control and UC Alarm Control

#### LCD Control

If the Auto LCD Dim option is set to NO, the backlighting of the LCD will remain on all the time. If the option is set to YES, the backlighting will automatically turn off 2 minutes after the last button is pressed.

#### UC Alarm Control

This setting is commonly used in pumping applications. If a well runs dry, the 777 Series will shut down the motor because of an undercurrent condition. Since this may occur frequently in pumping applications, the undercurrent faults can fill up the last four faults of the RM-2000-RTDW. If you do not want the fault screen to pop up on the RM-2000-RTDW when an undercurrent fault is detected, set this field to “NO”. This allows the last four faults to keep track of other, unexpected faults.

A	U	T	O		L	C	D		D	I	M	:		Y	E	S
A	L	A	R	M		O	N		U	/	C	:		Y	E	S

### Starting with Voltage Errors\*

This setting controls how a [RUN/RESET] button\* is handled when the 777 Series is trying to start, but voltage errors are present.

If a motor has been shut down and the 777 Series detects a voltage error—overvoltage, undervoltage, reverse phase, or voltage unbalance—the 777 Series will not close its control relay until the voltage fault goes away.

When “If Starting w/ Volt. Errors:” is set to SEND OFF—if the [RUN/RESET] button is pressed while the voltage faults are present—the RM-2000-RTDW will send an OFF command instead of a START command. This prevents the 777 Series from starting, even after the voltage fault goes away. The RM-2000-RTDW displays a message to report this change for about two seconds. The [RUN/RESET] button must be pressed again after the voltage faults are cleared to make the motor start.

When this setting is “SEND ON” and you push the [RUN/RESET] button, a START command will be sent to the 777 Series. When the 777 Series receives a START command, it will restart the control contacts as soon as the voltage fault goes away.

**\*The [RUN/RESET] button is currently non-functioning on the RM-2000-RTDW. Therefore, the Starting with Voltage Errors screen and functionality is not applicable.**

I	F		S	T	A	R	T	I	N	G		W	/	V	O	L	T	.
E	R	R	O	R	S	:					S	E	N	D		O	F	F

### Type of Events to Track

The RM-2000-RTDW will track up to 10 events with the date and time of each event. Specify YES or NO for each of the events according to your system preferences.

L	O	G		M	T	R		S	T	A	R	T	S	:		Y	E	S	
				M	T	R		S	T	O	P	S		:		Y	E	S	
L	O	G		R	M			P	W	R		O	N	:		N	O		
				R	M			P	W	R		L	O	S	:		N	O	
L	O	G		C	O	M	M		O	N				:		N	O		
				C	O	M	M		L	O	S	S		:		N	O		

### RTD Limits Settings - RTD trip and alarm limits (up to 8 RTDs).

The temperature measurements from a connected RTD module can be read by the RM-2000-RTDW. Alarm and trip limits can be entered into the RM-2000-RTDW (35°– 200°C or OFF) for each of the 8 RTDs. For the Renu FIOA RTD module, the:

>(E)< (ENABLED) or

>(D)< (DISABLED)

setting can be used to indicate an RTD input that has no connection. It can also be used to temporarily suspend an RTD connection without changing the trip and alarm settings.

RTD Trip level is exceeded = 777 output relay de-energizes (NO contact opens)

RTD Alarm level is exceeded = RTD ALARM relay energizes (NO contact closes)

R	T	D		#	1		T	R	I	P	:		1	1	0	°	C		
(	E	)					A	L	A	R	M	:		9	0	°	C		

### Minimum Time Between Starts

The Minimum Time Between Starts (MTBS) can be set from 0–60 Minutes. Each time the motor starts, the Minimum Time Before Next Start (FAULT HISTORY mode) begins counting down from the MTBS setting. The RM-2000-RTDW will prevent the motor from starting again until the timer expires. The MTBS cannot be overridden by pressing the remote reset button unless the key switch is on (K1 and K2 are shorted).

M	I	N	I	M	U	M		T	I	M	E		B	E	T	W	E	E	N
S	T	A	R	T	S	:			3	0		M	I	N	U	T	E	S	

### Motor Nameplate Volts/Amps

Used to view or set the nominal voltage and full load current of the motor.

The UC/OC and LV/HV warning levels are based on these two parameters.

N	o	m	.	V	o	l	t	a	g	e	:				4	8	0	V	
F	L	A		C	u	r	r	e	n	t	:				3	2	.	0	A

## Warning Levels –

Used to view or set the levels that control the WARNING relay.

Warning levels can be set as a percentage of the programmed limits for nominal voltage, full load current, current unbalance, and voltage unbalance (the setpoints for each parameter are displayed but cannot be changed on these screens). Each warning level can be set from OFF to 1275% in 5% increments and the screen will automatically show the warning level in amps, volts and percentages to simplify setup.

The WARNING relay functions as follows:

- If the **average** of the measured phase currents drops below the undercurrent warn level (UCWrn), the WARNING relay energizes.
- If **any** measured phase current exceed the overcurrent warn level (OCWrn), the WARNING relay energizes.
- If the **average** measured voltage is greater than the high voltage warn level (HVWrn), or less than the low voltage warn level (LVWrn), the WARNING relay is energized.
- If either the current unbalance (CUBWrn) or voltage unbalance (VUBWrn) warn level is exceeded, the WARNING relay is energized.

F	L	A	C	u	r	r	e	n	t	:				3	2	.	0	A
U	C	W	r	n	:			7	5	%	=			2	2	.	4	A

F	L	A	C	U	r	r	e	n	t	:				3	2	.	0	A	
O	C	W	r	n	:			1	1	5	%	=			3	6	.	7	A

N	o	m	.	V	o	l	t	a	g	e	:				4	8	0	V
L	V	W	r	n	:			9	5	%	=				4	5	6	V

N	o	m	.	V	o	l	t	a	g	e	:				4	8	0	V
H	V	W	r	n	:			1	1	5	%	=			5	5	2	V

C	U	B	S	e	t	P	t	:							6	%			
C	U	B	W	r	n	:			7	5	%	=			4	.	5	0	%

V	U	B	S	e	t	P	t	:							7	%			
V	U	B	W	r	n	:			8	0	%	=			5	.	6	0	%

## Output Relay Status –

Used to view or set the status of the RM-2000-RTDW output relays.

This screen is only visible if the I/O Screens are set to ON.

R	E	L	A	Y	A	:											O	F	F
R	E	L	A	Y	B	:											O	F	F

## I/O Screens

Displays or hides the input and output relay status screens.

I	/	O	S	c	r	e	e	n	s	:							O	F	F

## Slave and RTD Watchdog Commands

This screen allows you to control the WARNING, RTD and the 777 relays in the event of a communication loss. The relays function as follows:

- SlvComWd:WrnRly = ON: the WARNING relay will energize if the RM-2000-RTDW loses communication with the 777. WrnRly = OFF: no action.
- RTD:Rly = ON: the RTD relay will energize if the RM-2000-RTDW loses communication with the RTD module. RTD:Rly = OFF: no action.
- RTD:Trp = ON: the 777 will trip (relay de-energizes) if the RM-2000-RTDW loses communication with the RTD module. RTD:TRP = OFF: no action.

S	I	v	C	o	m	W	d	:	W	r	n	R	l	y	=	O	F	F	
R	T	D	:	R	l	y	=	O	F	F		T	r	p	=	O	F	F	

## Clear History & Faults

In the CHANGE SETUP mode, this screen allows you to clear the motor's history information that is displayed in the REAL TIME mode and you can clear the fault information displayed in the FAULT HISTORY mode.

C	L	E	A	R		H	I	S	T	O	R	:		N	O		
C	L	E	A	R		F	A	U	L	T	S	:		N	O		

## Clear Events & Minimum Off Time

In the CHANGE SETUP mode, CLEAR EVENTS will allow you to clear the 10 starting events. The CLEAR MIN OFF option allows you to clear the date and time of last start, the run time, the date & time of the Minimum Off Time, and the Minimum Off time.

C	L	E	A	R		E	V	E	N	T	S	:		N	O		
C	L	E	A	R		M	I	N		O	F	F	:		N	O	

## Change Option & Enable Start Stop

This screen will display whether changes are permitted by the RM-2000-RTDW.

If the Change Setup option displays NO, it is not possible to enter the CHANGE SETUP mode. The only way to set the Change Setup option to YES is to short K1 and K2.

The RM-2000-RTDW's [RUN/RESET] button is disabled. Setting En. Start/Stop to YES only enables the Stop button and allows you to send an off command to the 777.

C	H	A	N	G	E		S	E	T	U	P	:		Y	E	S	
E	N	.	S	T	A	R	T	/	S	T	O	P	:		Y	E	S

## Firmware Version

This screen is only displayed in the SETUP mode. It displays the firmware version number.

				R	M	-	2	0	0	0	-	R	T	D	W		
				V	e	r	s	i	o	n			3	.	2	2	

## **777-PLUS SERIES SUPPORT**

The RM-2000-RTDW supports the following features of the 777-Plus Series overload relay/power monitor:

- Voltage and Current reading
- Ground current fault readings
- Setpoint changes
- Power and Power factor readings
- Pending fault status
- Logging of faults codes

The RM-2000-RTDW has the following limitations in support of 777-Plus Series units

- Ground fault current will be logged with the fault data, but will max out if the current is above 2.52 amps for a 777-LR-P and 25.2 amps for a 777-P; however, the ground fault will still display correctly on the real-time screen.
- When reading a 777-Plus Series unit's ground fault currents over the network with the legacy memory map, the ground fault current will max out if above 2.52 amps for a 777-LR-P and 25.2 amps for a 777-P, however, the ground fault will still read correctly from the 777-Plus Series unit's memory map.



## **MEMORY MAP**

The RM-2000-RTDW uses a 16-bit memory map.

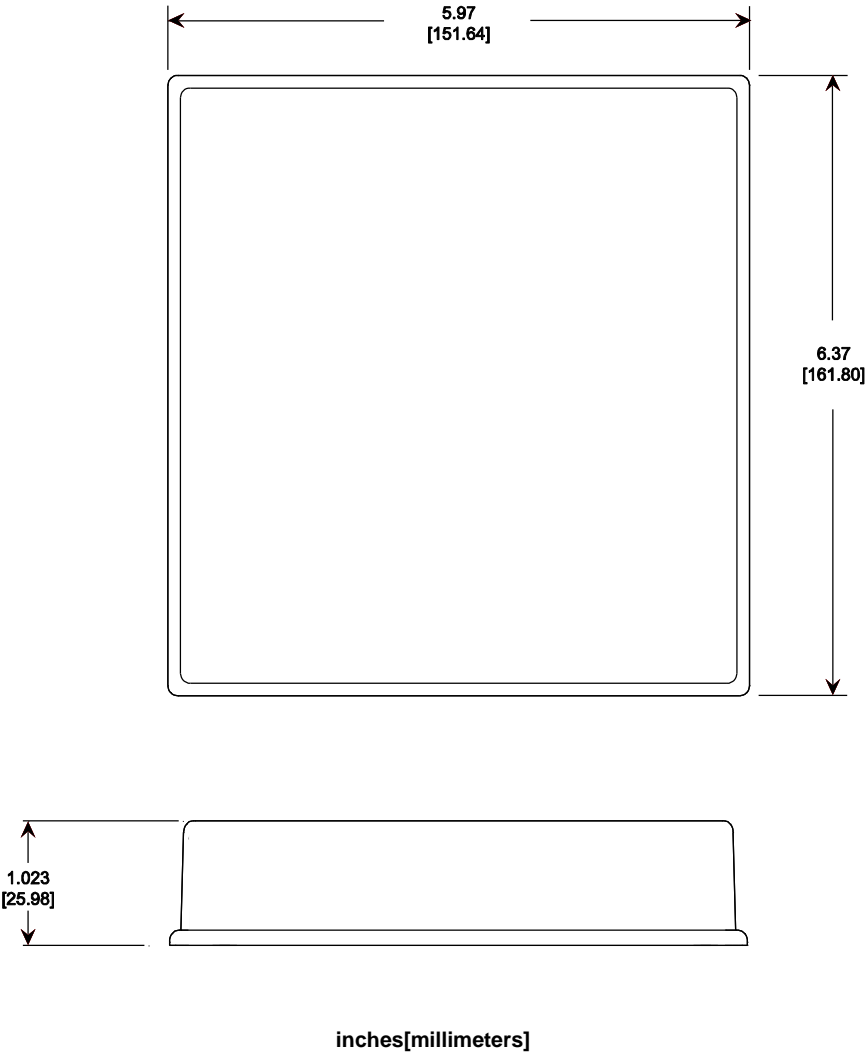
The 777-Plus Series overload relay/power monitor uses a 16-bit memory map, where all setpoints and real-time values will be read and written as 2-byte numbers. The 777-Plus series supports the legacy memory map that contains both 16-bit and 8-bit parameters.

Because of this difference when reading OC, UC, GF setpoints from the legacy memory map, in some cases the values will not match the front panel display. This is caused by mathematical rounding that occurs when converting from an 8-bit memory map to a 16-bit memory map. All trip conditions are based on what is displayed on the front panel of the 777-Plus Series unit. Refer to the appropriate 777 Series Programming Guide for more information.

### **RM-2000-RTDW Modbus Memory Map**

<b>Parameter</b>	<b>Address (Hex)</b>	<b>Address (Decimal)</b>	<b>Decimal Address +1 40001</b>
RTD Modbus Address	0x04D2	1234	41235
RTD Modbus BaudRate	0x04D3	1235	41236
RTD Modbus parity	0x04D4	1236	41237
RTD Modbus Stop bits	0x04D5	1237	41238
Min. Time Between Strts	0x04D6	1238	41239
RTD#1 – Trip setting	0x04D7	1239	41240
RTD#2 – Trip	0x04D8	1240	41241
RTD#3 – Trip	0x04D9	1241	41242
RTD#4 – Trip	0x04DA	1242	41243
RTD#5 – Trip	0x04DB	1243	41244
RTD#6 – Trip	0x04DC	1244	41245
RTD#7 – Trip	0x04DD	1245	41246
RTD#8 – Trip	0x04DE	1246	41247
RTD#1 – Alarm setting	0x04DF	1247	41248
RTD#2 – Alarm	0x04E0	1248	41249
RTD#3 – Alarm	0x04E1	1249	41250
RTD#4 – Alarm	0x04E2	1250	41251
RTD#5 – Alarm	0x04E3	1251	41252
RTD#6 – Alarm	0x04E4	1252	41253
RTD#7 – Alarm	0x04E5	1253	41254
RTD#8 – Alarm	0x04E6	1254	41255
Nominal Voltage	0x04E7	1255	41256
Nominal Current	0x04E8	1256	41257
Low Volt. Warn	0x04E9	1257	41258
High Volt. Warn	0x04EA	1258	41259
VUB Warn	0x04EB	1259	41260
OC Warn	0x04EC	1260	41261
UC Warn	0x04ED	1261	41262
CUB Warn	0x04EE	1262	41263
RTD#1 – Temperature	0x04EF	1263	41264
RTD#2 – Temp.	0x04F0	1264	41265
RTD#3 – Temp.	0x04F1	1265	41266
RTD#4 – Temp.	0x04F2	1266	41267
RTD#5 – Temp.	0x04F3	1267	41268
RTD#6 – Temp.	0x04F4	1268	41269
RTD#7 – Temp.	0x04F5	1269	41270
RTD#8 – Temp.	0x04F6	1270	41271
RTD Shorted Status	0x04F7	1271	41272
RTD Open Status	0x04F8	1272	41273
RTD Warning Status	0x04F9	1273	41274
RTD Relay Status	0x04FB	1275	41276

**DIMENSIONS**



## **RM-2000-RTDW SPECIFICATIONS**

RM-2000-RTDW SPECIFICATIONS			
Control Voltage	115VAC ±10%, 50 or 60Hz		
Transient Protection	2500V for 10ms		
Power Consumption	3 Watts (max.)		
Communication	MS 777	RTD Module	PC, PLC, etc.
Baud Rate	9600	300-28800	300-28800
Setup	Even Parity, 1 Stop Bit	None, Odd, or Even Parity, 1 or 2 Stop Bits	None, Odd, or Even Parity, 1 or 2 Stop Bits
Protocol	Modbus RTU	Modbus RTU	Modbus RTU
Serial Interface	RS485MS-2W	RS485MS-2W	RS485MS-2W
Available Addresses	A01-A99	Benshaw: 16-23 Renu: 1-64	A01-A99
Real-Time Clock			
Battery Back-up Life	10 years @ 25°C without external power		
Last Fault Memory	Stores up to 4 faults with time and date stamp, includes voltages and currents at time of trip		
Output Relays	Two independent electro-mechanical Form C (SPDT)		
Contact Material	Silver/Tin Oxide		
Pilot Duty Rating	240VA @ 120VAC		
General Purpose Rating	5A @ 120VAC		
Environment			
Class of Protection	NEMA 3R		
Ambient Operating Temperature	-20° to 70°C		
Ambient Storage Temperature	-30° to 70°C		
Humidity	Up to 85%, non-condensing		
Enclosure			
Dimensions	6.1" L x 6.5" W x 1.1" D		
Weight	1.2 lbs.		
Material	Black polycarbonate		
Display	Liquid crystal with extended temperature range		
Size	2 rows x 20 characters		
Lighting	LED backlight		
Keypad	Eight 0.5" stainless steel dome buttons for tactile feedback		
Mechanical Life	50,000 actuations		
Overlay Material	Polyester		
UV Exposure w/out Degradation	2000 hrs.		
Terminal	Depluggable terminal block		
Torque	3 in.-lbs. max.		

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