



Model RM-2000 CBM+

Remote Monitor for the 777 Series

Electronic Overload Relays/Power Monitors



UG-RM2000-CBM-C



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FEATURES

The RM-2000 CBM+ remote display monitors liquid level through pressure measurement and can be configured to control SymCom's 777 Series unit via an RS-485 Modbus network. A second communication port allows monitoring and control of up to 99 RM-2000 CBM+ devices from a personal computer (PC) with SymCom's Solutions software, or a PLC, DCS, or SCADA system. The RM-2000 CBM+ includes time logging and historical data tracking. It is environmentally protected and can easily be mounted on the front of a panel or MCC.

The RM-2000 CBM+ controls the pump by cycling the overload relay/power monitor (777 Series) based on pressure measurements from one or two 4-20mA pressure transducers. A built in flow meter signal conditioner and a RTD signal conditioner provide low cost water output monitoring and blower control features. An optional external flow meter can be used to measure flow rate and total output of the pump. The RM2000 CBM+ will also store the total flow output from the external flow meter over the last 24 hours in barrels for the last 31 days.

This system is compatible with a wide range of 4-20mA pressure transducers. The first transducer measures down-hole (liquid) pressure while an optional second transducer can be used to measure annulus (gas) pressure. The second transducer corrects head measurement inaccuracies caused by relatively high annulus pressure. The pump is started when the maximum head setpoint is exceeded and stopped when the minimum head setpoint is passed.

INFORMATION DISPLAYED

The RM-2000 CBM+ 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 CBM+ 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
- Head level with control setpoints
- Remaining off time
- Flow rate and flow total
- Gas pressure and cycle volume
- Daily flow total
- Pending faults

The RM-2000 CBM+ 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 CBM+ 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 CBM+ communicates with the 777 Series by an RS-485 cable which can be up to 4000 feet long. This allows the RM-2000 CBM+ to remotely monitor a 777 Series.

INSTALLATION

1. Attach the template drawing to the panel where the RM-2000 CBM+ is to be mounted.
2. Take caution when drilling the holes to mount the RM-2000 CBM+. 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 CBM+. Attach the RM-2000 CBM+ to the panel using the four screws provided.
4. Run the appropriate wires to the back of the RM-2000 CBM+ 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 Series, two 4-20mA transducer connections, and ground wire to case ground on the panel.

NOTE: The "Flow" connection on the RM-2000 CBM+ provides an optional connection to a 0-5V pulse external flow meter for measurement of cycle volume (pump throughput).

5. It is important to have the A phase of the breaker connected to L1 on the 777 Series, 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 CBM+, should be connected according to the wiring diagrams found in the **Installations Instructions** for the appropriate 777 Series product.
7. A jumper or switch may be placed across K1 and K2 to enable programming lock.¹

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

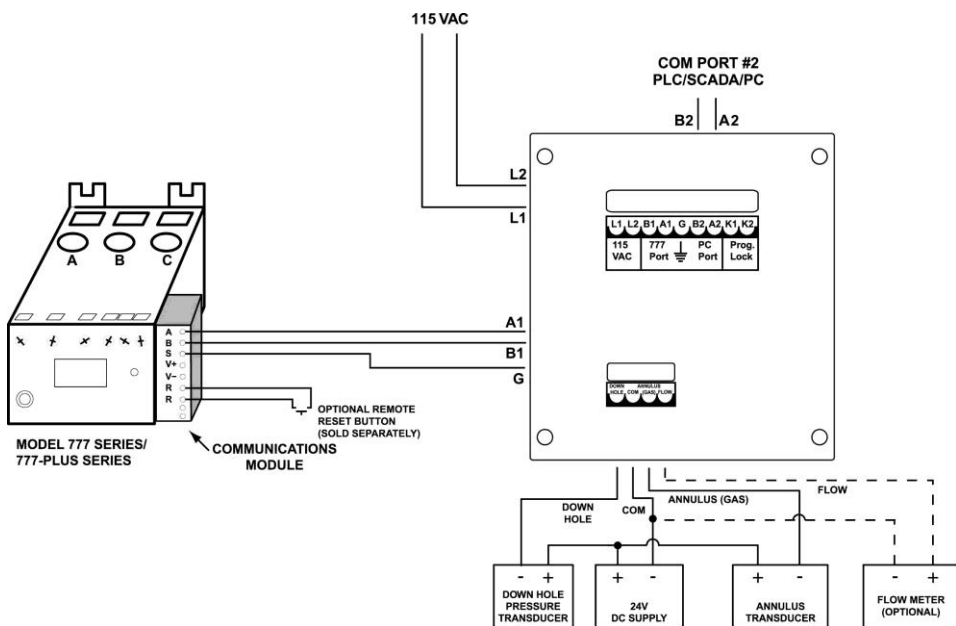


Figure 1: RM-2000 CBM+ Wiring Diagram

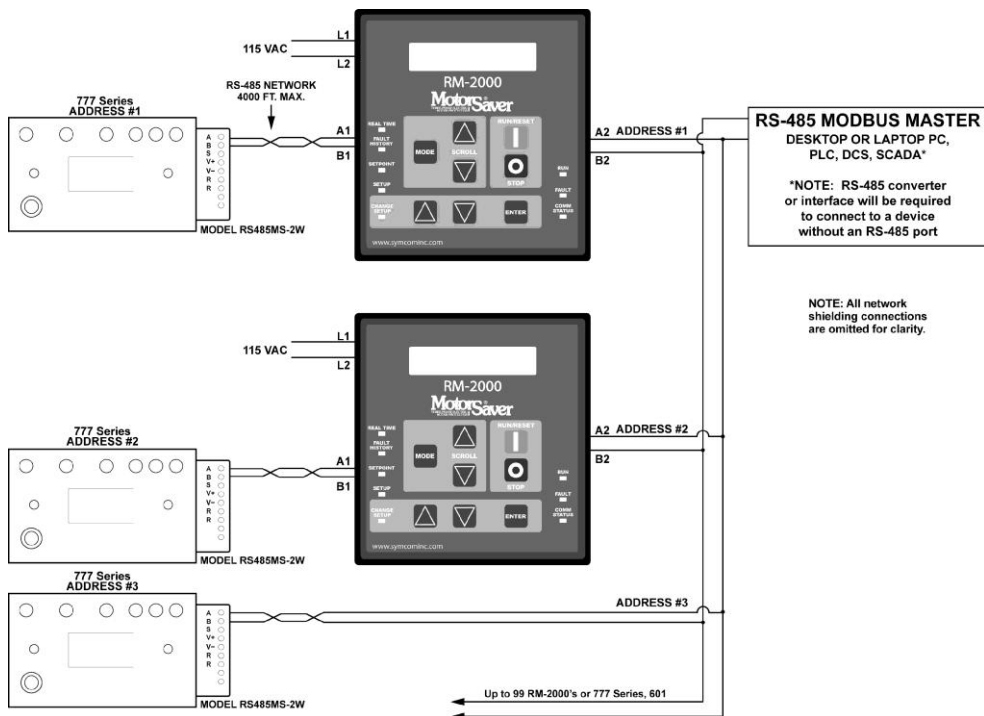


Figure 2: RM-2000 CBM+ Network Diagram

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 CBM+. Refer to the installation instructions or user's guide for the communications module in use.

The RM-2000 CBM+ 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 CBM+ can be programmed as device address A01– A99 and up to 99 RM-2000 CBM+ or 777 Series units can exist on the same network. The RM-2000 CBM+'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 CBM+ slave communication parameters must match the communication parameter of the attached overload. The network communication parameters of the RM-2000 CBM+ must be the same for all devices connected to the upstream network.

The RS-485 Network - Terminating Resistors

In Figure 2 there are three RS-485 networks. Each of the two RM-2000 CBM+ devices with their slave 777 Series forms a separate, independent RS-485 network. The third network links the host PC to the two RM-2000 CBM+ devices. Each independent network may require terminating resistors and may require a ground connection for the shield around the twisted pair cable.

If the length between the RM-2000 CBM+ and the 777 Series 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 CBM+ (across A1 and B1) and also at the 777 Series (across A and B of the RS485MS-2W module). In addition, the shield of the twisted pair cable should be tied to the RM-2000 CBM+ 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 CBM+ is capable of supplying enough current to operate the RS-485 network, even with terminating resistors installed. The RM-2000 CBM+ to host is a separate network and may require separate terminating resistors and ground connection.

CONNECTIONS - EXISTING NETWORK INSTALLATIONS

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

The RM-2000 CBM+ will map the data from the 777 Series into the same register locations as the 777 Series, so the RM-2000 CBM+ will respond just like the 777 Series as far as the Modbus Master software application is concerned. The Modbus Master software will not have to be reprogrammed to communicate with the RM-2000 CBM+, unless the additional information from the RM-2000 CBM+ is desired.

OPERATION

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

- REAL TIME
- FAULT HISTORY
- SETPOINT
- SETUP²
- 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 CBM+ 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' 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 CBM+, 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 connected between K1 and K2 on the back of the RM-2000 CBM+ 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.

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

LED STATUS INDICATION

Eight LEDs indicate the status of the RM-2000 CBM+:

- Five red LEDs on the left side indicate the display mode.
- The green COMM STATUS LED on the lower right indicates the RM-2000 CBM+ is communicating with the 777 Series.
- The green RUN LED on the top of the right column 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 CBM+ automatically switches to the FAULT HISTORY mode and displays FAULT 1—the most recent fault. The RM-2000 CBM+ 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 allowing the motor to start, 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 CBM+ loses communications with the 777 Series, the green COMM STATUS LED will not be lit and the REAL TIME mode screens will contain asterisks. For example, the screen showing 3-phase voltages and the average voltage 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. Refer to the installation instructions and programming guide for the particular model of relay or communications module for setup instructions.
- 3) Verify the cable connects A1 of the RM-2000 CBM+ to A of the communications module and B1 to B.
- 4) If using an older communications module, Model **RS485MS**, verify that a jumper is placed between A and Y, and a second jumper is placed between B and 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!**).

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	=			3	0	.	4			3	0	.	2			3	0	.	3
V	=			4	5	8				4	5	2				4	6	0	

Line Currents and Average Current

Displays individual phase currents and average current.

I	a	=		3	0	.	4				I	b	=		3	0	.	2		
I	c	=		3	1	.	5				I	a	v	g	=		3	0	.	7

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 CBM+ will be higher than the voltage displayed on the 777 Series, but will be consistent with the actual voltage.

V	a	b	=		4	5	6				V	b	c	=		4	5	2	
V	a	c	=		4	6	0				V	a	v	g	=		4	5	6

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	=			1	%

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 CBM+ 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	.	0
E	N	E	R	G	Y	-	K	W	H	=						0	.	9

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 Model 601, be sure to set the Model to 601 in the CHANGE SETUP mode. This allows the Frequency information of the Model 601 to be displayed on this screen instead of Average Voltage and Average Current.

V	A	V	=			4	5	8	I	A	V	G	=			3	0	.	7
P	O	W	E	R	F	A	C	T	O	R	=					0	.	9	9

Power and KVARs

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

P	O	W	E	R	(	K	W	)	=							2	3	.	7	2
K	V	A	R	S				=								2	.	3	3	

Pending Fault Information

The Pending Fault screen will display up to three pending faults the 777 Series has sensed. The RM-2000 CBM+'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 allowing the motor to start. The RM-2000 CBM+ 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
HP	High Power

LPr Low Power

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

CBM REAL-TIME MODE SCREENS

Head Level with Control Setpoints

This screen shows the current head level between the lower and upper head level setpoints. A signal to energize the 777 Series control relay is sent when the max head setpoint is exceeded. A signal to de-energize the 777 Series control relay is sent when the level drops below the minimum head setpoint.

H	d	O	f	f				H	e	a	d		H	e	a	d	O	n
		0						1	0	0			1	0				

Remaining Off Time

This screen shows the status of the minimum off time counter. The pump will not start automatically if 0 min is not shown. This timer can be bypassed by pressing the RUN button on the RM-2000 or by sending a RUN command from the network.

NOTE: The pump will not automatically start if the RD1, RD2 or RD3 timers in the 777 Series are counting down.

See also: Real time display of the 777's RD1, RD2 and RD3 timers.

O	f	f		T	i	m	e		R	e	m	a	i	n	i	n	g		
									0		M	i	n						

Flow Rate and Flow Total (requires optional flow meter)

This screen shows the current flow rate in gallons per minute and the first flow meter (current flow total) in gallons. The total flow total is the amount of flow since the last reset.

						0		g	p	m									
								4	9		g	a	l						

Gas Pressure and Cycle Volume (requires optional flow meter)

This screen shows the gas pressure and cycle volume (second flow meter). The gas pressure is measured in psi and the cycle volume is measured in gallons. **NOTE: An external flow meter is required to measure this attribute.**

G	a	s		P	r	e	s					0		p	s	i			
C	y	c	l	e		V	o	l				0		g	a	l			

Daily Flow Total (requires optional flow meter)

This screen shows the total flow output for a 24 hour period in barrels over the last 31 days. The most recent 24 hour flow total is listed in Day 1.

D	a	y	1									0		b	a				
D	a	y	2									0		b	a				

FAULT HISTORY MODE

Fault Information

The RM-2000 CBM+ 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 CBM+ 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	1	5	/	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	=		
		3	0	.	4				3	0	.	2				3	3	.	6

Fault Voltages

Displays voltage measurements just before the fault.

F	A	U	L	T		1			V	O	L	T	A	G	E	S	=		
			4	5	8					4	5	2					4	6	0

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	=			7	%	
A	V	E	R	A	G	E		C	U	R	R	.	=				3	1	.	4

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	=			1	%
A	V	E	R	A	G	E		V	O	L	T	.	=				4	5	6

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 CBM+ will store the time of the last 10 events: motor starts, motor stops, RM-2000 CBM+ power on, RM-2000 CBM+ power loss, communication on, and 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	1	5	/	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	1	5	/	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

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	1	5	/	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		T	I	M	E	:								
								1		M	I	N			2		S	E	C

CHANGE SETUP MODE

The CHANGE SETUP³ 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

³ K1 and K2 must be connected or key switch enabled.

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 CBM+, without interrupting the 777 Series' control relay.

Current Limits

Used to view or set overload and underload limits.

O	V	E	R		C	U	R	R	.	:			3	5	.	1	
U	N	D	E	R		C	U	R	R	.	:			2	5	.	2

Voltage Limits

Used to view or set HV and LV settings.

O	V	E	R		V	O	L	T	.	:				5	0	6	
U	N	D	E	R		V	O	L	T	.	:			4	1	4	

Unbalance Limits

Used to view or set 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 MULT and GF settings.⁴

C	U	R	R	.		M	U	L	T	:						1	
G	R	N	D		F	A	U	L	T	:		3	.	2	0	A	

Restart Delays⁵

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 TC and UCTD settings.

T	R	I	P		C	L	A	S	S	:					1	0	
---	---	---	---	--	---	---	---	---	---	---	--	--	--	--	---	---	--

⁴ The CURR MULT settings will be "N/A" for a 777-P series.

⁵ This screen shows the setpoint for each restart delay, not the time remaining.

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	:	A	U	T	O

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	:			o	c	A

Power Limits

Used to view or set high and low kW settings.

H	I	G	H		K	W	:							6	5	5	.	3	4
---	---	---	---	--	---	---	---	--	--	--	--	--	--	---	---	---	---	---	---

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

L	O	W		K	W	:								2	1	.	5	0
---	---	---	--	---	---	---	--	--	--	--	--	--	--	---	---	---	---	---

Table 1: 777-P Multiplier / Divisor Settings

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

777-P Multiplier/Divisor

Used to view or set multiplier and divisor setpoints for 777-P Series⁶.

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

⁶ This screen only appears if the RM-2000 CBM+ is connected to a 777-P series device.

Message Builder

The message builder screen allows you to read and write 777 Series information⁷. 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	

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

Model and Software

M	o	d	e	l	:											7	7	7
S	o	f	t	w	a	r	e		R	e	v	:		2	5	.	3	8

⁷ Please refer to SymCom's 777 Programming Guide for more information.

SETUP MODE

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

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 - 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 Series Port Communication Parameters

The RM-2000 CBM+ supports multiple communication settings for use with different SymCom power monitors and overload relay as well as different communications modules. The RM-2000.-CBM+ must be set to match the 777 Series or communications module installed. Please review the appropriate documentation.

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 CBM+ and a PC with SymCom's *Solutions* software, or a PLC, DCS, or SCADA system. Up to 99 RM-2000 CBM+s can exist on this network; thus, the network address can be set from 00001–00099.

		N	E	T	W	O	R	K		(P	O	R	T		2)		
		N	E	T	W	O	R	K		A	D	D	R	:	0	0	0	0	1

Network Port Communication Parameters

The RM-2000 CBM+ 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	:	E					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.

- 1) **Send OFF** – when an upstream communication watchdog occurs, the RM-2000 CBM+ will send an off command to the overload, de-energizing the 777 Series' output relay. Use the Send OFF feature if you want the overload fault relay to open when the RM-2000 CBM+ loses communications with the network host.
- 2) **Send RHWD (Remote Host Watchdog)** (If the overload supports this feature) – When an upstream communication watchdog occurs, the RM-2000 CBM+ will send a remote host watchdog command to the overload. The overload will immediately perform its configured watchdog action. The standard 777 Series does not support this feature.

	N	e	t	w	o	r	k		W	a	t	c	h	d	o	g			
											D	I	S	A	B	L	E	D	

Model and Voltage Multiplier

Model Number

The Model Number setting should match the model number of the 777 Series monitored by the RM-2000 CBM+. **NOTE: When using with the 777-LR-P, select Model “777-P” in setup.**

Voltage Multiplier

Voltage Multiplier should be set to 1 unless the 777 Series 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 CBM+ will adjust the power factor to correct the Power, kVARs, and Energy Usage values. Be sure to check the 777-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. The backlight will come on again once a 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 CBM+. If you do not want the fault screen to pop up on the RM-2000 CBM+ 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	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 is no longer present.

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 CBM+ 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 CBM+ 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.

	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 CBM+ 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		

Level Control Enable

The level control enable can be set to enable or disable the head level control setpoints **(See Turn Off and Turn On Setpoints)**. If the level control is disabled, the setpoints will still appear but will be disabled.

		L	e	v	e	l		C	o	n	t	r	o	l						
		E	n	a	b	l	e	d	?					Y	E	S				

Down-Hole Pressure Transducer Full Scale

The full scale range of the down-hole transducer can be configured from 50-600 psi in 5 psi steps. This is the adjustable full scale range of the 4-20mA pressure transducer. The down-hole transducer and internal flow meter are used to determine the head level.

D	o	w	n	H	o	l	e	T	r	a	n	s	d	u	c	e	r
F	u	l		S	c	a	l	e	3	5	0	P	S	I			

Annulus (Gas) Pressure Transducer Full Scale

The full scale range of the annulus transducer can be configured from 15-600 psi in 5 psi steps. This is the adjustable full scale range of the 4-20mA pressure transducer.

	A	n	n	u	l	u	s		T	r	a	n	s	d	u	c	e	r	
F	u	l		S	c	a	l	e		2	0	0		P	S	I			

Turn Off Setpoint

The head turn off setpoint can be adjusted from 10-245 ft. The turn off setpoint can never be set greater than or equal to the turn on setpoint.

T	u	r	n	O	f	f	S	e	t	p	o	i	n	t			
						0	F	t									

Turn On Setpoint

The head turn on setpoint can be adjusted from 15-250 ft. It can never be set less than or equal to the turn off setpoint.

[illegible]

Minimum Off Time / Under Pressure Restart Delay

An additional rapid-cycle timer is provided in the RM-2000 CBM+. This timer is started whenever the pump is stopped from the RM-2000. The timer will keep the pump off for a specified duration after the minimum head level is passed. It will also keep the pump from immediately restarting after pressing the stop button on the RM-2000. The timer range is 2-250 min. The accuracy is ± 1 min.

	M	i	n	i	m	u	m		O	f	f	T	i	m	e				
						1	5		m	i	n								

K Factor (requires optional external pulse flow meter)

The k factor is a constant that is measured in pulses per gallon and can be adjusted from 10 to 2000 pulse/gal.

K	F	a	c	t	o	r	P	u	l	s	e	/	g	a	l	
						1	2	0	0							

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	Y	:		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 CBM+.

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 connect K1 and K2.

The EN. START/STOP option will allow you to use the [RUN/RESET] and [STOP] buttons if the option is saved as YES.

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

R	e	m	o	t	e		M	a	n	a	g	e	r		2	0	0	0
			V	e	r	s	i	o	n				3	.	2	0		

777-PLUS SERIES SUPPORT

The RM-2000 CBM+ 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 CBM+ 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 CBM+ uses an 8-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.

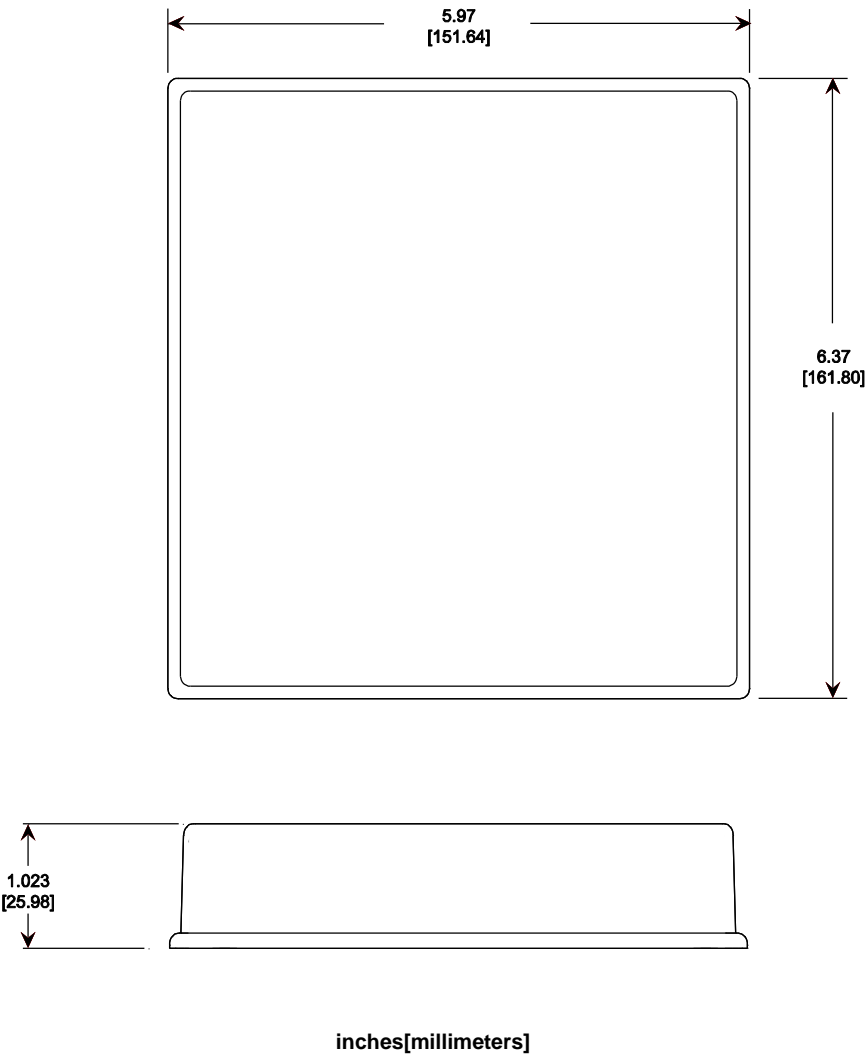
Because of this difference when reading OC, UC, GF setpoints from the legacy memory map, in some cases the values will not match the front panel display. This is caused by mathematical rounding that occurs when converting from an 8-bit memory map to a 16-bit memory map. All trip conditions are based 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 CBM Modbus Memory Map

Parameter	Address (Hex)	Address (Decimal)	Decimal Address + 40001
Time Off SP	0x0FD8	4056	44057
Head Off (LB)	0x0FD9	4057	44058
Head On (LB)	0x0FDA	4058	44059
DH Offset	0x0FDB	4059	44060
An Offset	0x0FDC	4060	44061
Head Off (HB)	0x0FE5	4069	44070
Head On (HB)	0x0FE6	4070	44071
FlowMeter2	0x0FEB	4075	44076
DH Range	0x0FED	4077	44078
An Range	0x0FEF	4079	44080
Full Scale DH	0x0FF3	4083	44084
Full Scale An	0x0FF5	4085	44086
Pulses per Gallon	0x0FF7	4087	44088
FlowMeter (HB)	0x0FF9	4089	44090
FlowMeter (LB)	0x0FFB	4091	44092
Head	0x0FFD	4093	44094
Time off Count	0x00A1	161	40162
Flow Rate	0x00A2	162	40163
Gas Pressure	0x00A3	163	40164
Daily Flow Totals			
Day 1 Flow	0x412E	16686	56687
Day 2 Flow	0x4130	16688	56689
Day 31 Flow	0x416A	16746	56747
KVARs	0x0129	297	40298
Energy Usage (kWh)	0x012D	301	40302
Configuration Options ⁸	0x04C9	1225	41226

⁸ Bit 5 of Configuration Options is specific to the RM-2000 CBM+. Set Bit 5 to enable head control.

DIMENSIONS



RM-2000 CBM+ SPECIFICATIONS

Functional Characteristics															
Control Voltage	115VAC \pm 10%, 50/60Hz														
Transient Protection	2500V for 10ms														
Communications	<table> <tr> <th>Overload Comm. Settings</th><th>PC, PLC, etc.</th></tr> <tr> <td>Baud Rate</td><td>300-28800</td></tr> <tr> <td>Setup</td><td>None, Odd, or Even</td></tr> <tr> <td></td><td>Parity, 1 or 2 Stop Bits</td></tr> <tr> <td>Protocol</td><td>Modbus RTU</td></tr> <tr> <td>Serial Interface</td><td>RS485MS-2W</td></tr> <tr> <td>Available Addresses</td><td>A001-A099</td></tr> </table>	Overload Comm. Settings	PC, PLC, etc.	Baud Rate	300-28800	Setup	None, Odd, or Even		Parity, 1 or 2 Stop Bits	Protocol	Modbus RTU	Serial Interface	RS485MS-2W	Available Addresses	A001-A099
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Baud Rate	300-28800														
Setup	None, Odd, or Even														
	Parity, 1 or 2 Stop Bits														
Protocol	Modbus RTU														
Serial Interface	RS485MS-2W														
Available Addresses	A001-A099														
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														
General Characteristics															
Maximum Input Power	3 W														
Terminal	Depluggable terminal block														
Torque	3 in.-lbs. max.														
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.														
Electrical Noise Immunity															
Electrostatic discharge	IEC 61000-4-2, Level 3 (6kV contact, 8kV air discharge)														
Electrostatic field	IEC 61000-4-3, Level 3 (10V/m)														
Fast transient burst	IEC 61000-4-4, Level 4+, 4kV power supply port and 2kV inputs/output ports														
Surge	IEC 61000-4-5, 24V supply, Level 1 (\pm 500V) RS-485 & Reset Lines, Level 2 (\pm 1kV)														
Conducted RF	IEC 61000-4-6, Level 3+ (30V _{rms})														
Environment															
Class of Protection	NEMA 3R / UL Type 12														
Ambient Operating Temperature	-20° to 70°C -4° to 158°F														
Ambient Storage Temperature	-30° to 70°C -22° to 158°F														
Humidity	Up to 85%, non-condensing														
Enclosure															
Dimensions	6.1" L x 6.5" W x 1.1" D (154.94 x 165.1 x 27.94 mm)														
Weight	1.2 lbs. (544.3 g)														
Material	Polycarbonate														

NOTES

NOTES

For warranty information, please see **Terms and Conditions** at
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