

# MOTOR & PUMP PROTECTION

Prevent damage to motors caused by overloads, jams, phase loss or unbalance, heat from non-electric sources, heavy start-ups and excessive operational cycles. Dynamic thermal curves, as well as integrated protection, metering, and data-logging functions extend motor life and maximize process efficiency.

PGR-6100 Series	Motor Ground-Fault & Insulation Relay 94
PGR-6101-120	Motor Ground-Fault & Insulation Relay 95
MPU-32 Series	Motor Protection Unit96
MPS Series	Motor Protection System
MPU-32-X69X Series	Motor Protection Relay Retrofit Kit 100
MPS-469X Series	Motor Protection Relay Retrofit Kit 100
111-Insider-P / 231-Insider-P	Single-Phase Pump Monitor
232-Insider	Single-Phase Pump Monitor
111P / 233P / 233P-1.5 Series	Single-Phase Pump Monitor
234-P	Single-Phase Pump Monitor
235P	Single-Phase Pump Monitor
MP8000 Series	Bluetooth <sup>®</sup> Current & Voltage Monitor 112
777 Series	3-Phase Current & Voltage Monitor
777 / 77C Series	Single-Phase Current & Voltage Monitor 118
777-KW/HP-P2 Series	3-Phase Current & Voltage Monitor
777-AccuPower	3-Phase Current & Voltage Monitor
77C-KW/HP Series	Single-Phase Current & Voltage Monitor 125
SIO-RTD-02-00	Temperature Input Monitor



#### For More Information...

and to download our Motor Protection Brochure or White Paper, click on Technical Resources at Littelfuse.com/MotorProtection

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# PGR-6100 SERIES (GFR4000)

## Ground-Fault & Insulation Monitor





## Simplified Circuit Diagram



## **Ordering Information**

ORDERING NUMBER	CONTROL POWER
PGR-6100-120	120 Vac
PGR-6100-240 <sup>(1)</sup>	240 Vac (1)
ACCESSORIES	REQUIREMENT
SE-CS30 Series	Required
PGH Family	Required >1300 V
PGA-0500	Optional
PGA-0510	Optional

Note (1) - PGR-6100-240 ordering option is not UL Listed. For optional conformal coating please consult factory.

## Description

The PGR-6100 combines the features of a ground-fault protection relay and insulation monitor into one unit. It protects against ground faults by monitoring insulation resistance when the motor is de-energized and by monitoring ground-fault current when the motor is energized. The PGR-6100 features two separate analog outputs for optional current and ohm meters, and two separate alarm relays. It operates on one- or three-phase solidly grounded, resistance-grounded and ungrounded systems up to 6 kV.

## Features & Benefits

FEATURES	BENEFITS
Adjustable GF pickup (10 mA - 3 A)	Trip setting provides a wide range of low-level protection and system coordination
Adjustable insulation pickup (250 kΩ - 2 MΩ)	Customizable insulation resistance setpoints for maximum protection
Adjustable time delay (50 ms-1.0 s)	Adjustable trip delay for quick protection and system coordination
Output contacts	Two Form C output contacts for ground fault and insulation-resistance fault
Analog outputs (0-1 mA)	Two analog outputs indicate insulation resistance and ground-fault current
CT-Loop monitoring	Alarms when CT is not connected
Selectable contact operating mode	Selectable fail-safe or non-fail-safe operating modes allows connection to shunt or undervoltage breaker coil

## Accessories



#### SE-CS30 Series Ground-Fault CTs

Required zero-sequence current transformer specifically designed for low level detection. Flux conditioner is included to prevent saturation.



#### **PGH Family High Tension Couplers** Required (for systems >1,300 V) PGH Family hightension coupler must be connected between the phase conductor and the PGR-6100.



#### **PGA-0500 Analog % Current Meter PGA-0510 Analog Ohm Meter** Optional panel-mounted meters display ground-fault current as a percentage of the set-point and insulation resistance.

Specifications

#### IEEE Device Numbers

Input Voltage Dimensions Response delay Contact Operating Mode Harmonic Filtering Test Button Reset Button CT-Loop Monitoring Output Contacts Analog Output Approvals Warranty Mounting Ground Fault (50G/N, 51G/N), Ground detector (64), Alarm Relay (74) *See ordering information* **H** 75 mm (3"); **W** 100 mm (3.9"); **D** 115 mm (4.5") < 50 ms Selectable fail-safe or non-fail-safe Standard feature Standard feature Standard feature Standard feature Two Form C 0-1 mA UL Listed (E183688) <sup>(1)</sup> 5 years DIN, Surface

www.littelfuse.com/pgr-6100

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US

# PGR-6101-120 (GFR4001)

## Ground-Fault & Insulation Monitor



## Simplified Circuit Diagram



## **Ordering Information**

ACCESSORIES	REQUIREMENT
SE-CS30 Series	Required
PGH Family	Required >1300 V
PGA-0500	Optional
PGA-0510	Optional

For optional conformal coating please consult factory.

## Description

The PGR-6101-120 combines the features of a ground-fault protection relay and insulation monitor into one unit. It protects against ground faults by monitoring insulation resistance when the motor is de-energized and by monitoring ground-fault current when the motor is energized. The PGR-6101-120 features two separate analog outputs for optional current and ohm meters, and two separate alarm relays. It operates on one- or three-phase solidly grounded, resistance grounded and ungrounded systems up to 6 kV.

## Features & Benefits

FEATURES	BENEFITS
Adjustable GF pickup (30-200 mA)	Trip setting provides a wide range of low-level protection and system coordination
Adjustable insulation pickup (60-600 kΩ)	Customizable insulation resistance setpoints for maximum protection
Adjustable time delay (50-250 ms)	Adjustable trip delay for quick protection and system coordination
Output contacts	Two Form C output contacts for ground fault and insulation-resistance fault
Analog outputs (0-1 mA)	Two analog outputs indicate insulation resistance and ground-fault current
CT-Loop monitoring	Alarms when CT is not connected
Selectable contact operating mode	Selectable fail-safe or non-fail-safe operating modes allows connection to shunt or undervoltage breaker coil

## Accessories



## SE-CS30 Series Ground-Fault Transformers

Required zero-sequence current transformer specifically designed for low level detection. Flux conditioner is included to prevent saturation.



#### PGH Family High Tension Couplers Required (for systems >1,300 V) PGH Family hightension coupler must be connected between the



PGA-0500 Analog % Current Meter PGA-0510 Analog Ohm Meter Optional panel-mounted meters display ground-fault current as a percentage of the

phase conductor and the PGR-6101-120.

set-point and insulation resistance.

## Specifications

IEEE Device Numbers

Input Voltage Dimensions Response delay Contact Operating Mode Harmonic Filtering Test Button Reset Button CT-Loop Monitoring Output Contacts Analog Output Approvals Warranty Mounting Ground Fault (50G/N, 51G/N), Ground detector (64), Alarm Relay (74) 120 Vac H 75 mm (3"); W 100 mm (3.9"); D 115 mm (4.5") < 50 ms Selectable fail-safe or non-fail-safe Standard feature Standard feature Standard feature Standard feature Two Form C 0-1 mA UL Listed (E183688) 5 years DIN, Surface

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# MPU-32 SERIES (PGR-6200)

#### Motor Protection Unit





## **Simplified Circuit Diagram**



## **Ordering Information**

MOTOR & PUMP PROTECTION

ORDERING NUMBER	COMMUNICATION
MPU-32-00-00	TIA-232
MPU-32-01-00	TIA-232 & TIA-485
MPU-32-02-00	TIA-232 & DeviceNet™
MPU-32-04-00	TIA-232 & EtherNet/IP™ & Modbus® TCP

NOTE: One of the following is required: MPU-CIM-00-00 Current Input Module, or MPU-CTI-RT-00 Current Input Module with ring-tonque terminals.

ACCESSORIES	REQUIREMENT
Phase CTs	Required
MPS-RTD-01-00	Optional
MPS-DIF-01-00	Optional
MPU-32-SMK	Optional
CA-945	Optional
MPU-16A-Y92A-96N	Optional

## Description

The MPU-32 Motor Protection Unit is used to provide currentand temperature-based protection, metering, and data logging for three-phase low-voltage medium-horsepower induction motors. This relay is ideal for retrofitting and upgrading obsolete or aging motor protection using existing CTs. See the PMA Family of Panel Mount Adapter Kits to replace common obsolete relays.

#### Motor Protection Unit

- Three ac-current inputs
- Earth-leakage-CT input
- Programmable digital input
- 24-Vdc source for digital input
- Programmable 4-20-mA analog output
- On-board temperature-sensor input,
- 100-Ω-Platinum RTD or PTC
- Three programmable output relays
- Local RS-232 communications, optional Network
  Communications
- PC-interface software (SE-Comm-RIS)
- 4 line x 20 character backlit LCD display
- Keypad for programming and display selection
- 4 LEDs; 1 user programmable

#### 2 Current Input Module (MPU-CIM)

The MPU-CIM Current Input Module is the interface between the MPU-32 relay and the 5-A-secondary, 1-A-secondary, and sensitive current transformers. The MPU-CIM is ordered separately from the MPU-32 and can be surface or DIN-rail mounted. Wire-clamping terminals are standard, but the MPU-CTI is available for those who require ring-tongue terminals.

#### Accessories

#### Phase Current Transformers

Phase CTs are required to detect phase currents. For upgrade applications, existing CTs can be used.



#### Ground-Fault Current Transformer

Optional zero-sequence current transformer detects ground-fault current. Available with 5-A and 30-A primary ratings for low-level pickup.



**MPS-RTD Temperature Input Module** Optional module provides 8 inputs to connect Pt100, Ni100, Ni120, and Cu10 RTDs.



#### **MPS-DIF Differential Current Module** Optional motor differential protection, compatible with core balance and summation current transformer connections.

www.littelfuse.com/mpu-32

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# MPU-32 SERIES (PGR-6200)



#### **Features & Benefits**

FEATURES	IEEE #	BENEFITS
Overload	49, 51	Extends motor life and prevents insulation failures and fires
Dynamic thermal model		Provides protection through starting, running, and cooling cycles
Communications		Remotely view measured values and event records, reset trips, and access setpoints
Ground fault	50G/N, 51G/N	Prevents catastrophic failures and fires
Current unbalance/ Phase loss/Phase reverse	46	Prevents overheating due to unbalanced phases
RTD temperature	38, 49	RTD temperature protection (MPS-RTD module) for high-ambient or loss-of-ventilation protection
Phase loss/Phase reverse (current)	46	Detects unhealthy supply conditions
Overcurrent	50, 51	Prevents catastrophic failures and fires; extends motor life
Jam		Prevents motor damage by detecting mechanical jams or excessive loading
Undercurrent	37	Detects low level or no-load conditions
PTC overtemperature	49	Overtemperature (PTC) protection for high-ambient or loss-of-ventilation detection
Starts per hour	66	Limits the motor starts per hour to prevent overheating
Differential	87	Optional MPS-DIF module for sensitive winding-fault protection
Reduced overcurrent mode		Minimizes arc-flash hazards during maintenance
Metering		View measured and calculated parameters with on-board display
MPU-CIM		Separate current input module to reduce risk of open-CT hazard and for convenient installation
Analog output		Provides means for metering selectable parameters
Data logging		On-board 100-event recorder for data logging
Conformal coating		Internal circuits are conformally coated to protect against corrosion and moisture

## **Wiring Diagram**



#### Specifications Protective Functions

<b>Protective Functions</b>	Overload (49, 51) RTD temperature (38		
(IEEE Device Numbers)	Phase reverse (current) (46)	Unbalance (current) (46)	
	Overcurrent (50, 51)	Starts per hour (66)	
	Jam	Differential (87)	
	Ground fault (50G/N, 51G/N)	Phase loss (current) (46)	
	PTC overtemperature (49	Undercurrent (37)	
Input Voltage	65-265 Vac, 25 VA; 80-275 Vdc, 2	5 W	
Power-Up Time	800 ms at 120 Vac		
<b>Ride-Through Time</b>	100 ms minimum		
24-Vdc Source	100 mA maximum		
AC Measurements	True RMS and DFT, Peak, 16 sa	imples/cycle, and	
	positive and negative sequence	e of fundamental	
Frequency	50, 60 Hz or ASD		
Output Contacts	Three Form C programmables		
Communications	TIA-232 (standard); TIA-485, Device	eNet™,	
	Ethernet (optional)		
Analog Output	4-20 mA, programmable		
Conformally Coated	Standard feature		
Warranty	10 years		
Mounting			
(Control Unit)	Panel (standard)		
(,	Surface (with MPU-32-SMK co	nverter kit)	
(Current Input Module)	DIN Surface		
Annrovals	CSA certified CE (European Union) III Recognized		
	C-Tick (Australian)		

# MPS SERIES (PGR-6300)

## Motor Protection System





## Simplified Circuit Diagram



## Ordering Information

ORDERING NUMBER	COMMUNICATIONS
MPS-CTU-01-00	RS-485
MPS-CTU-02-00	RS-485 & DeviceNet™
MPS-CTU-03-00	RS-485 & Profibus®
MPS-CTU-04-00	RS-485 & EtherNet/IP™ & Modbus <sup>®</sup> TCP

ACCESSORIES	REQUIREMENT
MPS-OPI-01-00	Recommended
Phase CTs	Required
Ground-Fault CT	Recommended
MPS-RTD-01-00	Optional
MPS-DIF-01-00	Optional
SE-IP65CVR-M	Optional

## Description

The MPS Motor Protection System monitors voltage, current, and temperature to provide a comprehensive package of 22 protective functions. The MPS is a modular system with integrated protection, motor control, metering, and data-logging functions. This system is typically used to provide protection for three-phase low- and medium-voltage, medium- to highhorsepower induction motors.

#### Operator Interface (MPS-OPI)

- Large, bright, 4 x 20 vacuum-fluorescent display
- Display metered values
- Access set points
- Powered by Control Unit
- Panel mount or attach directly to Control Unit
- Remote mounting (1.2 km or 4000 ft maximum loop length)
- 1/2 DIN size
- Hazardous-location certified

#### 2 Control Unit (MPS-CTU)

- Current inputs—5-A or 1-A secondary phase current transformers
- Voltage inputs—up to 600 V without PTs
- Earth-leakage input—5-A or 1-A secondary or sensitive transformer
- Tachometer (high-speed pulse) input
- 8 digital inputs, 5 relay outputs, 1 analog input and output
- 24-Vdc supply for OPI and RTD modules, and for digital inputs
- IRIG-B time-code input
- 1/2 DIN size, surface mount
- RS-485 network communications (Standard)

phase currents.

■ DeviceNet<sup>™</sup>, Profibus<sup>®</sup>, or Ethernet communications available

#### Accessories



**Phase Current Transformers** Phase CTs are required to detect



#### Ground-Fault Current Transformer Required zero-sequence current transformer

detects ground-fault current. Available with 5-A and 30-A primary ratings for low-level pickup.



**MPS-RTD Temperature Input Module** Optional module provides 8 inputs to connect Pt100, Ni100, Ni120, and Cu10 RTDs.



#### **MPS-DIF Differential Current Module** Optional motor differential protection, compatible with core balance and summation current transformer connections.

www.littelfuse.com/mps

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# MPS SERIES (PGR-6300)



## **Features & Benefits**

FEATURES	IEEE #	BENEFITS
Overload	49, 51	Extends motor life and prevents insulation failures and fires
Current unbalance/ Phase loss/Phase reverse	46	Prevents overheating and extends motor life
Overcurrent/Jam	50, 51	Prevents catastrophic failures and fires and extends motor life
Undercurrent	37	Detects low-level or no-load conditions
Ground fault	50g/N, 51G/N	Prevents catastrophic failures and fires
RTD temperature	38, 49	Optional RTD temperature protection (MPS-RTD module) for high ambient or loss of ventilation protection
Overvoltage	59	Prevents stress to insulation
Undervoltage	27	Prevents a start attempt when it will damage the motor
Voltage unbalance	47	Detects unhealthy supply voltage
Phase differential	87	Provides sensitive protection for high-resistance winding faults
Dynamic thermal mode		Provides protection through starting, running, overload, and cooling cycles
Reduced overcurrent mode		Minimizes Arc-Flash hazards during maintenance
Starter control		Simplifies the installation by reducing component count
Metering		Displays the measured and calculated motor parameters
Data logging		On-board 64-event recorder helps with system diagnosis
Communications		Remotely view measured values, event records & reset trips
Conformal coating		Internal circuits are conformally coated to protect against corrosion and moisture

## Wiring Diagram



#### Specifications Protective Functions

Protective Functions	Overload (49, 51)	Unbalance (current) (46)	
(IEEE Device Numbers)	Phase reverse (current) (46) Underspeed (14)		
	Overfrequency (81)	Starts per hour (66)	
	Overcurrent (50, 51)	Phase loss (voltage) (47)	
	Jam	Overvoltage (59)	
	Underfrequency (81)	Differential (87)	
	Ground fault (50G/N, 51G/N)	Phase loss (current) (46)	
	Undercurrent (37)	Undervoltage (27)	
	Unbalance (voltage) (47)	Phase reverse	
	Failure to accelerate	(voltage) (47)	
	RTD temperature (38, 49)	Power factor (55)	
Input Voltage	65-265 Vac, 25 VA; 80-275 Vdc, 2	5 W	
Power-Up Time	800 ms at 120 Vac		
<b>Ride-Through Time</b>	100 ms minimum		
24-Vdc Source	100 mA maximum		
AC Measurements	True RMS and DFT, Peak, 16 samples/cycle, and		
	positive and negative sequence	e of fundamental	
Frequency	50, 60 Hz or ASD		
Inputs	Phase current, Earth-leakage current, Phase voltage,		
	7 digital, tachometer, 1 analog		
Output Contacts	5 contacts — See Product Manua	al	
Approvals	CSA Certified, RCM (Australian), UL Recognized		
Communications	Allen-Bradley <sup>®</sup> DFI and Modbus <sup>®</sup> RTU (Standard);		
	DeviceNet <sup>™</sup> , Profibus <sup>®</sup> , Etherne	et (Optional)	
Conformally Coated	Standard feature		
Warranty	10 years		
Mounting			
(Control Unit)	Surface		
(Operator Interface)	Panel, Control-Unit mounted		

# MPU-32-X69X (PGR-6210) SERIES / MPS-469X (PGR-6310) SERIES

## Motor Protection Retrofit Kits

## 1 MPU-32-X69X





Front

Back

#### 2 MPS-469X



Front



#### Description

Littelfuse Startco retrofit kits are an excellent choice for upgrading motor protection, providing current- and temperature-based protection, metering, and data logging.

#### 1 MPU-32-X69X

The MPU-32-X69X Motor Protection Retrofit Kit is designed to replace GE Multilin 169, 269, and 369 relays. It includes the MPU-32 Motor Protection Relay, MPU-CIM Current Input Module, and optional MPS-RTD Temperature Input Modules, which are pre-wired on a panel. The kit fits in the existing space and typically can utilize existing current transformers and wiring to simplify the upgrade procedure.

#### 2 MPS-469X

The MPS-469X Motor Protection Retrofit Kit replaces the GE Multilin 469 relay. It includes the MPS Motor Protection System and optional RTD and differential modules mounted on a panel that can be installed in the existing 469 cutout. Existing current transformer and wiring can be utilized, simplifying the upgrade procedure.

## **Features & Benefits**

FEATURES	BENEFITS
Mounting	Fits in existing mounting holes and panel openings
Quick installation	Existing CTs and RTDs can be used to reduce installation time
Factory tested	100% factory-tested, pre-assembled components ensure reliability
Communications	Add communications capability to older switchgear and improve system performance
Microprocessor based	No calibration required saves on maintenance cost
Reduced overcurrent mode	Maintenance mode setting to reduce the risk of Arc-Flash Hazards
Conformal coating	Protects circuit boards against corrosion and moisture
Additional protection	Additional protective functions, including dynamic thermal model and ability to match existing overcurrent curves

## MPU-32-X69X Ordering Information

		RTD INPUTS	MPU-32 COMMUNICATIONS	GROUND-FAULT CT	FUTURE OPTIONS
MPU-32-X69X	-	Х	Х	X	00
		$0 = One Platinum 100 \Omega$	0 = TIA232	0 = Wired for Sensitive Ground-Fault CT (50 mA Secondary)	
		1 = One Platinum 100 Ω and 8-input MPS-RTD Module	1 = TIA232 & TIA485	1 = Wired for 1- or 5-A Secondary Ground-Fault CT	
			2 = TIA232 & DeviceNet		
			4 = TIA232 & Ethernet		
	V				

#### MPS-469X Ordering Information

		MODULE CONFIGURATION	MPS COMMUNICATIONS	FUTURE OPTIONS
MPS-469X	-	X	X	000
		0 = None	1 = RS485	
		1 = One MPS-RTD Module	2 = RS485 & DeviceNet	
		2 = Two MPS-RTD Modules	3 = RS485 & Profibus	
		3 = One MPS-DIF Module	4 = RS485 & Ethernet	
		4 = One MPS-RTD Module and One MPS-DIF Module		

www.littelfuse.com/mpu-32-X69X, www.littelfuse.com/mps-469X

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## Single-Phase Pump Monitor



Answers Delivered



#### Wiring Diagrams

See next page.

#### Accessories



#### Informer

A hand-held diagnostic tool that uses an infrared receiver to access information which can be helpful for troubleshooting the system. Includes the Informer IR Kit-12

# (h)

#### Informer IR Kit-12

12" infrared adapter cable attaches to the face of the unit to provide remote diagnostics without opening the panel. Included with the Informer

## **Ordering Information**

MODEL	VOLTAGE	DESCRIPTION
111-Insider-P	115VAC	⅓ - ½ hp, includes IR Kit-12
231-Insider-P	230VAC	⅓ - 1 hp, includes IR Kit-12

#### Description

The Littelfuse 111-Insider-P single-phase products fit inside  $\frac{1}{3}$  and  $\frac{1}{2}$ , 115V control boxes and the 231-Insider-P fits inside  $\frac{1}{3}\frac{1}{2}$ ,  $\frac{3}{4}$ , and 1 hp, 230V control boxes. Both models are designed to protect single-phase pumps from dry-well, dead-head, jammed impeller, rapid-cycle, overvoltage, and undervoltage conditions.

A calibration adjustment allows the Insider to be calibrated to your specific pumping applications, thereby reducing the possibility of false or nuisance tripping. A unique microcontroller-based voltage and current-sensing circuit constantly monitors the incoming power for fluctuations, overcurrent, and undercurrent. When an abnormality, such as loss of suction is detected, the product deactivates its output relay and directly disconnects the pump motor. The unit then begins its user-selectable restart delay (dry-well recovery) timer. When the timer counts to zero or power is removed and reapplied, the unit reactivates its output relay and turns the pump back on. By leaving the restart delay knob in the reset position, the unit will operate in manual reset mode.

The Insider communicates with a hand-held diagnostics tool called the Informer (sold separately). The Informer displays parameters including calibration points, trip points, run time and last faults. An IR Kit-12 (12" fiber optic kit) is included with each Insider, allowing the Informer to access these parameters even when the Insider is enclosed in a control box. This is valuable for troubleshooting the pump while it is running.

NOTE: The 111/231-Insider-P models have a sensitivity adjustment for the dry-well trip point. After calibration is done, you can adjust the sensitivity for the dry-well/dead-head trip point from 70-90% of the full load. This makes the unit even more adaptable to varying pumping applications. If you have a very low producing well, you increase the sensitivity closer to the 90% mark, or if you have a very heavy producing well, you would decrease the sensitivity around the 70% mark.

## Features & Benefits

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of voltage and current protects pumps from dry-well, dead-head, jammed impeller, rapid cycling, and voltage faults
Onboard sensitivity adjustment	Allows user to adjust the current sensitivity for the dry-well / dead-head trip point from 70% - 90% of the full load.
Adjustable restart delay	Allows user to select well recovery time delay after a dry-well condition occurs, or to select manual reset
Built in IR communications link	Used with the Informer, allows user to see stored faults, run time, and also troubleshoot the pump while it's running
LED indication	Provides status and diagnostics for troubleshooting

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## 111-INSIDER-P / 231-INSIDER-P

#### **Specifications**

#### **Functional Specifications** Adjustments/Settings

Overcurrent Underload (dry-well) **Overvoltage** 111-Insider-P 231-Insider-P Undervoltage 111-Insider-P 231-Insider-P Number of restarts allowed in a 60-sec. period (rapid-cycling) **Trip Delay Times** Overcurrent Dry-well **Restart Delay Times Over/Undervoltage** All other faults

125% of calibration point Adjustable (70 to 90% of calibrated run power)

132.5VAC 265VAC

95VAC 190VAC

4

5 seconds 4 seconds

2 seconds Manual, 2-225 minutes

#### **Input Characteristics Supply Voltage**

111-Insider-P 115VAC 231-Insider-P 230VAC Load Range 111-Insider-P 1/3 - 1/2 hp 231-Insider-P ⅓–1hp Frequency 50\*/60Hz **Output Characteristics Output Contact Rating-SPST** 111-Insider-P 231-Insider-P **General Characteristics Operating Temperature Maximum Input Power** 5 W Safety Marks cUR\*\* Weight 10 oz. **Mounting Methods** 

1/2hp@120VAC (17 amps max.) 1hp@ 240VAC (17 amps max.)

-40° to 60° C (-40° to 140° F)

UL508, C22.2 No. 14 Inside a Pentek<sup>®</sup>, Franklin<sup>™</sup>, CentriPro<sup>™</sup>, Flint and Walling™, and Grundfos®\*\*\* control box

\*Note: 50Hz will increase all delay timers by 20%

\*\*The 111-Insider-P and 231-Insider-P are approved by UL for use in the Franklin™, Pentek®, and CentriPro™ type 3R control boxes when installed as described in the installation instructions. The 111-Insider-P and 231-Insider-P are not intended to provide overload protection, and should be used with thermally or impedance protected motors only.

\*\*\*Grundfos control boxes manufactured after mid 2014.

#### Wiring Diagrams

PENTEK® CONTROL BOX WIRING DIAGRAM



#### FRANKLIN™ CONTROL BOX WIRING DIAGRAM



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# 111-INSIDER-P / 231-INSIDER-P

#### CENTRIPRO<sup>™</sup> CONTROL BOX WIRING DIAGRAM



#### **GRUNDFOS® CONTROL BOX\* WIRING DIAGRAM**



\* For boxes manufactured in mid 2014 or later. See 232-INSIDER on next page for boxes manufactured prior to mid 2014.



# For installation instructions see the Fresh Water Pumping Catalog at www.Littelfuse.com/PumpProtection

#### FLINT AND WALLING<sup>™</sup> CONTROL BOX WIRING DIAGRAM

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232-INSIDER

# Single-Phase Pump Monitor





#### **Wiring Diagram**

232-INSIDER CONNECTIONS IN GRUNDFOS® CONTROL BOX



For installation instructions see the Install Bulletin.

#### Description

The Model 232-Insider single-phase PumpSaver® fits inside 1/3, 1/2, 3/4, and 1hp, 230V Grundfos control boxes manufactured prior to mid 2014. The PumpSaver® Model 232-Insider is a pump monitor designed to protect single-phase pumps from dry-well, deadhead, jammed impeller, overvoltage and undervoltage conditions. Typical applications include residential water wells, commercial water wells, irrigation wells, and golf course systems.

A calibration adjustment allows the 232-Insider to be calibrated to your specific pumping application, thereby reducing the possibility of false or nuisance tripping. A unique microcontrollerbased voltage and current-sensing circuit constantly monitors the incoming power for fluctuations, overcurrent, and undercurrent. When an abnormality, such as loss of suction is detected, the 232-Insider deactivates its output relay and directly disconnects the pump motor. The 232-Insider then begins its user-selectable restart delay (dry-well recovery) timer. When the timer counts to zero or power is removed and reapplied, the 232-Insider reactivates its output relay and turns the pump back on. By leaving the restart delay knob in the reset position, the 232-Insider will operate in manual reset mode.

The Insider communicates with a hand-held diagnostics tool called the Informer (sold separately). The Informer displays parameters including calibration points, trip points, run time and last faults. This is valuable for troubleshooting the pump while it is running.

Note: The use of flow restrictors or unusually high head pressures at the time of calibration may interfere with the detection of dead-head conditions. Contact Littelfuse for information on a product to fit these applications.

## **Features & Benefits**

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of voltage and current protects pumps from dry-well, dead-head, jammed impeller, and voltage faults
Adjustable restart delay	Allows user to select well recovery time delay after a dry-well condition occurs, or to select manual reset
Built in IR communications link	Used with the Informer, allows user to see stored faults, run time, and also troubleshoot the pump while it's running
LED indication	Provides status and diagnostics for troubleshooting

#### Accessories

# -

**Informer** A hand-held diagnostic tool that uses an infrared receiver to access information which can be helpful for troubleshooting the system.

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# 232-INSIDER



#### **Specifications**

**Functional** Adjustments/Settings Overcurrent Underload (dry-well) Underload (dry well) with high sensitivity jumper removed Overvoltage Undervoltage **Trip Delay Times** Overcurrent Dry-well **Restart Delay Times** Over/undervoltage All other faults (dry-well recovery timer) **Input Characteristics** Supply Voltage Load Range Frequency **Output Characteristics Output Contact Rating-SPST General Characteristics Operating Temperature** Maximum Input Power **Safety Marks** UL CSA Weight **Mounting Methods** 

125% of calibration point Approx. 80% of calibration point Approx. 87% of calibration point 265VAC 190VAC 5 seconds 4 seconds 2 seconds Manual, 2-225 minutes 230VAC <sup>1</sup>/₃ – 1 hp 50\*/60Hz 1hp@240VAC (17 amps max.) -40° to 60° C (-40° to 140° F) 5 W UL508 C22.2 No. 14 10 oz.

Grundfos® Control Box manufactured

prior to mid 2014

\*Note: 50 Hz will increase all delay timers by 20%



# 111P / 233P / 233P-1.5 SERIES

## Single-Phase PumpSaver®



# Contraction of the second seco

## Wiring Diagram



For dimensional drawing see: Appendix page 511, Figure 15.

#### **Ordering Information**

MODEL	LINE VOLTAGE	DESCRIPTION
111P	115VAC	Load Range: ½ - 1hp
111P-ENCL	115VAC	111P with NEMA3R enclosure
233P	230VAC	Load Range: ½ - 3hp
233P-ENCL	230VAC	233P with NEMA3R enclosure
233P-1.5	230VAC	Load Range: ½ - 1.5hp
233P-1.5-ENCL	230VAC	233P-1.5 with NEMA3R enclosure

#### Description

The Littlefuse Models 111P (115 volt,  $\frac{1}{3}$  to 1hp); 233P-1.5 (230 volt,  $\frac{1}{3}$  to 1.5hp); and 233P (230 volt,  $\frac{1}{3}$  to 3hp) protect pumps from dry-well, dead-head, jammed impeller, overvoltage/ undervoltage conditions and now rapid-cycle protection whether the pressure switch is mounted before or after our unit.

A calibration adjustment allows the unit to be calibrated to your specific pumping applications, thereby reducing the possibility of false or nuisance tripping. A unique microcontroller-based voltage and current-sensing circuit constantly monitors the incoming power for fluctuations, overcurrent, and undercurrent. When an abnormality, such as loss of suction is detected, the unit deactivates its output relay and directly disconnects the pump motor. The unit then begins its user-selectable restart delay (dry-well recovery) timer. When the timer counts to zero or power is removed and reapplied, the unit reactivates its output relay and turns the pump back on.

The infrared LED communicates with a hand-held diagnostics tool called the Informer (sold separately). The Informer displays parameters including calibration points, trip points, run time and last faults.

**Special considerations for pump cables larger than #10 AWG:** In some cases where larger motors are installed with deep set pumps, pump cables are used that exceed the relay's terminal size. In these conditions, a short splice of #10 AWG or #12 AWG may be a solution at the control box. Note: All local, state and national electric codes should be followed when applying this solution.

NOTE: The 111P/233P/233P-1.5 models have a sensitivity adjustment for the dry-well trip point. After calibration is done, you can adjust the sensitivity for the dry-well/dead-head trip point from 70-90% of the full load. This makes the unit even more adaptable to varying pumping applications. If you have a very low producing well, you increase the sensitivity closer to the 90% mark, or if you have a very heavy producing well, you would decrease the sensitivity around the 70% mark.

## **Features & Benefits**

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of voltage, power factor, current for reliable pump protection
Onboard calibration process	Calibrates unit to your specific individual pumping application and reduces nuisance tripping
Onboard sensitivity adjustment	User adjustable sensitivity knob makes the unit more adaptable to varying pumping applications

#### Accessories



#### Informer

A hand-held diagnostic tool that uses an infrared receiver to access information which can be helpful for troubleshooting the system.

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# 111P / 233P / 233P-1.5 SERIES



## **Specifications**

**Functional Specifications** Adjustments/Settings Overcurrent Underload (dry-well) Overvoltage 111P 233P, 233P-1.5 Undervoltage 111P 233P. 233P-1.5 Number of restarts allowed in a 60-sec. period (rapid-cycling) 4 **Trip Delay Times** Overcurrent Dry-well **Restart Delay Times** Over/undervoltage All other faults **Input Characteristics Supply Voltage** 111P 233P-1.5, 233P Load Range: 111P 233P-1.5 233P Frequency

125% of calibration point Adjustable (70 to 90% of calibrated run power)

132.5VAC 265VAC

95VAC 190VAC

5 seconds 4 seconds

2 seconds Manual, 2-225 Minutes

115VAC 230VAC

⅓–1hp ⅓–1.5 hp 1/3 – 3 hp 50\*/60Hz

#### **Output Characteristics Output Contact Rating-SPST**

111P 233P-1.5 233P **General Characteristics Operating Temperature Maximum Input Power** Wire Gauge **Terminal Torque** Safety Marks cUL Listed

Weight **Mounting Methods** 

Dimensions

1hp@120VAC (16 amps max.) 1.5hp@240VAC (10 amps max.) 3hp@240VAC (17 amps max.)

-40° to 60° C (-40° to 140° F) 5 W Solid or Stranded 10 - 22AWG 13 in.-lbs.

UL508, C22.2 No. 14 H 73.66 mm (2.9"); W 133.35 mm (5.25"); **D** 73.99 mm (2.913") 14 oz. #8 screws

\*Note: 50Hz will increase all delay timers by 20%

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# 234-P

## Single-Phase Pump Monitor



## Wiring Diagram

234-P CONNECTIONS IN GRUNDFOS® CONTROL BOX



For installation instructions see the Install Bulletin.

## Description

The PumpSaver® Model 234-P is designed to be mounted inside a Grundfos® control box to protect  $1/_3$  – 3hp, 2- or 3-wire, 230V pumps.

The Model 234-P protects single-phase pumps from dry-well, dead-head, rapid-cycle, jammed-impeller, and over/undervoltage conditions. Typical applications include residential waterwells, commercial waterwells, irrigation wells, and golf course and other sprinkler systems.

A calibration adjustment allows the 234-P to be calibrated to your specific pumping applications, thereby reducing the possibility of false or nuisance tripping. A unique microcontrollerbased voltage and current-sensing circuit constantly monitors the incoming power for fluctuations, overcurrent, and undercurrent. When an abnormality, such as loss of suction is detected, the 234-P deactivates its output relay and directly disconnects the pump motor. The 234-P then begins its userselectable restart delay (dry-well recovery) timer. When the timer counts to zero or power is removed and reapplied, the 234-P reactivates its output relay and turns the pump back on. By leaving the restart delay knob in the reset position, the 234-P will operate in manual reset mode.

The 234-P communicates with a hand-held diagnostics tool called the Informer (sold separately). The Informer displays parameters including calibration points, trip points, run time and last faults. An IR Kit-12 (12" fiber optic kit) allows the Informer to access these parameters even when the 234-P is enclosed in a control box. This is valuable for troubleshooting the pump while it is running.

NOTE: The PumpSaver® models have a sensitivity adjustment for the dry-well trip point. After calibration is done, you can adjust the sensitivity for the dry-well/dead-head trip point from 70-90% of the full load. This makes the unit even more adaptable to varying pumping applications. If you have a very low producing well, you increase the sensitivity closer to the 90% mark, or if you have a very heavy producing well, you would decrease the sensitivity around the 70% mark.

The Model 234-P is not recommended for use with the Grundfos® Deluxe Control Box.

## **Features & Benefits**

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of voltage and current protects pumps from dry-well, dead-head, jammed impeller, rapid cycling, and voltage faults
Onboard sensitivity adjustment	Allows user to adjust the current sensitivity for the dry-well / dead-head trip point from 70% - 90% of the full load.
Adjustable restart delay	Allows user to select well recovery time delay after a dry-well condition occurs, or to select manual reset
Built in IR communications link	Used with the Informer, allows user to see stored faults, run time, and also troubleshoot the pump while it's running
LED indication	Provides status and diagnostics for troubleshooting



#### Accessories

234-P



#### Informer

A hand-held diagnostic tool that uses an infrared receiver to access information which can be helpful for troubleshooting the system. Includes the Informer IR Kit-12



#### Informer IR Kit-12

12" infrared adapter cable attaches to the face of the unit to provide remote diagnostics without opening the panel. Included with the Informer

#### **Specifications**

Functional Specifications	
Adjustments/Settings	
Overcurrent	125% of calibration point
Underload (dry-well)	Adjustable (70 - 90% of calibrated run power)
Overvoltage	265VAC
Undervoltage	190VAC
Number of restarts allowed	
in a 60-second period	
(rapid-cycling)	4
Trip Delay Times	
Overcurrent	5 seconds
Dry-well	4 seconds
Restart Delay Times	
Over/undervoltage	2 seconds
All other faults (dry-well	
recovery timer)	Manual, 2-225 Minutes
Input Characteristics	
Supply Voltage	230VAC
Load Range	1∕₃ – 3 hp
Frequency	50*/60Hz
Output Characteristics	
Output Contact Rating (SPST)	3 hp @ 240VAC (17 amps max.)
General Characteristics	
Operating Temperature	-40° to 60° C (-40° to 140° F)
Maximum Input Power	5W
Dimensions	Fitted to Grundfos <sup>®</sup> Control Box
Weight	14 oz.
Mounting Methods	Grundfos <sup>®</sup> Control Box
Standards Passed	
Electrostatic Discharge (ESD)	IEC 61000-4-2, Level 2, 4kV contact, 6kV air

\*Note: 50 Hz will increase all delay timers by 20%

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# 235P

## Single-Phase Pump Monitor



## Wiring Diagram



#### For dimensional drawing see: Appendix page 511, Figure 15.

#### **Ordering Information**

MODEL	LINE VOLTAGE	DESCRIPTION
235P	230VAC	5 - 15hp
235P-ENCL	230VAC	233P with NEMA3R enclosure

PART*	SIZE	CURRENT (A)	CT CURRENT RATIO
CT-0050-D10	5 - 7.5hp	27.5 - 42.1	50:5
CT-0075-D10	10hp	51	75:5
CT-0100-D10	15hp	75	100:5

Description

The Littelfuse 235P is designed to protect 5-15hp, 230V, single-phase pumps from dry-well, dead-head, jammed impeller and overvoltage and undervoltage conditions.

A calibration adjustment allows the 235P to be calibrated to your specific pumping applications, thereby reducing the possibility of false or nuisance tripping. A unique microcontrollerbased voltage and current-sensing circuit constantly monitors the incoming power for fluctuations causing overcurrent and undercurrent. When an abnormality, such as loss of suction is detected, the 235P deactivates its output relay and directly disconnects the pump motor. The unit then begins its userselectable restart delay (dry-well recovery) timer. When the timer counts to zero or power is removed and reapplied, the unit reactivates its output relay and turns the pump back on.

The 235P communicates with a hand-held diagnostics tool called the Informer (sold separately). The Informer displays parameters including calibration points, trip points, run time and last faults.

An external current transformer is required for operation (sold separately).

**Special considerations for pump cables larger than #10 AWG:** In some cases where larger motors are installed with deep set pumps, pump cables are used that exceed the relay's terminal size. In these conditions, a short splice of #10 AWG or #12 AWG may be a solution at the control box. Note: All local, state and national electric codes should be followed when applying this solution.

NOTE: The 235P model has a sensitivity adjustment for the dry-well trip point. After calibration is done, you can adjust the sensitivity for the dry-well/dead-head trip point from 70-90% of the full load. This makes the unit even more adaptable to varying pumping applications. If you have a very low producing well, you increase the sensitivity closer to the 90% mark, or if you have a very heavy producing well, you would decrease the sensitivity around the 70% mark.

## **Features & Benefits**

FEATURES	BENEFITS
Proprietary microcontroller based circuitry	Constant monitoring of voltage and current protects pumps from dry-well, dead-head, jammed impeller, rapid cycling, and voltage faults
Onboard sensitivity adjustment	Allows user to adjust the current sensitivity for the dry-well / dead-head trip point from 70% - 90% of the full load.
Adjustable restart delay	Allows user to select well recovery time delay after a dry-well condition occurs, or to select manual reset
Built in IR communications link	Used with the Informer, allows user to see stored faults, run time, and also troubleshoot the pump while it's running
LED indication	Provides status and diagnostics for troubleshooting

\* Current transformer sold separately

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#### Accessories

235P



#### Informer

A hand-held diagnostic tool that uses an infrared receiver to access information which can be helpful for troubleshooting the system. Includes the Informer IR Kit-12

#### **Specifications**

## Functional Specifications

Adjustments/Settings Overcurrent Underload (dry-well) Overvoltage Undervoltage Number of restarts allowed in a 60-sec. period (rapid-cycling) Trip Delay Times Overcurrent Dry-well Restart Delay Times Over/undervoltage All other faults

125% of calibration point Adjustable (70 to 90% of calibrated run power) 265VAC 190VAC

5 seconds 4 seconds

4

2 seconds Manual, 2-225 Minutes

#### **Input Characteristics**

Supply Voltage Load Range Frequency Output Characteristics Output Contact Rating-SPST General Characteristics

Operating Temperature Maximum Input Power Wire Gauge Terminal Torque Safety Marks cUL Listed Dimensions

Weight Mounting Methods 230VAC 5 - 15 hp 50\*/60Hz

Output Contact Rating-SPST A300, 720A @240VAC (10 amps max.)

-40° to 60° C (-40° to 140° F) 5 W Solid or Stranded 10 - 22AWG 13 in.-lbs.

UL508, C22.2 No. 14 H 73.66 mm (2.9"); W 133.35 mm (5.25"); D 73.99 mm (2.913") 14 oz. #8 screws

\*Note: 50Hz will increase all delay timers by 20%)

Dimensions Weight Mounting Methods H 73.66 mm (2.9"); W 133.35 mm (5.25"); D 73.99 mm (2.913") 14 oz. #8 screws

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Protection Relays Motor and Pump Protection – 3-Phase Motor Protection

MP8000 SERIES

#### Bluetooth® 3-Phase Current & Voltage Monitor





## Wiring Diagram



For dimensional drawing see: Appendix page 516, Figure 50.

#### Description

The MP8000/MP8100 are advanced motor protection electronic overload relays, fully programmable via Bluetooth<sup>®</sup> using an iPhone<sup>®</sup> or Android<sup>™</sup> smartphone or tablet with the Littelfuse App. It is easy to use and arc-flash safety is increased because the app allows settings to be modified and real-time operational information viewed. Viewing operational information and faults on the app does not require the user to open the control panel.

The MP8000 protects any motor drawing 0.5-1,000 full load Amps (external CTs are required above 100 Amps). It is designed for single or 3-phase systems with operating voltages of 90-690 VAC (use of external potential transformers can extend upper voltage range above 690 VAC). Common applications include conveyor systems, HVAC equipment, saws and grinders, fan motors, and almost any pumping application.

Protection is unsurpassed by combining overload, voltage, phase loss and reversal, voltage and current unbalance, power monitoring, and underload in one package. For standalone applications, the Bluetooth<sup>®</sup> interface can be used when paired with a smartphone or tablet. The units also feature an Ethernet communications port that can be used to form an Ethernet Modbus TCP/IP network. Units can be remotely monitored and controlled from a PC, or SCADA system, and data logging through a PC with the optional Solutions software or other software program using the MP8000 memory map. This capability allows for a simple cost-effective way to further enhance arc-flash safety.

## Features & Benefits

FEATURES	BENEFITS
Bluetooth® interface	Visual indication for programming, viewing real-time voltage or current, and last fault information (date and time stamped)
Programmable voltage and current settings	Allows usage on wide range of systems
3 selectable restart options	Choose from automatic, semi-automatic, or manual to best meet individual application needs
4 programmable delay timers	Program separate delay times for power up, rapid cycle protection, motor cool down, and underload restarting
Flexible reset	Reset can be done through pushbutton on panel, remotely via the network
Network communications capability	Compatible with Ethernet Modbus TCP/IP

#### **Ordering Information**

MODEL	LINE VOLTAGE	MOTOR FULL AMP RANGE	DESCRIPTION
MP8000	90-690VAC (use of external potential transformers can extend upper voltage range above 690VAC)	0.5-1,000A (external CTs required above 100A)	Provides remote wired communication via Ethernet Modbus TCP/IP
MP8100	90-690VAC (use of external potential transformers can extend upper voltage range above 690VAC)	0.5-1,000A (external CTs required above 100A)	Provides remote wired communication via Ethernet Modbus TCP/IP, RS485, and CAN bus

www.littelfuse.com/mp8000

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# MP8000 SERIES



#### **Advanced Features**

- Overload (Overpower)
- Underload (Underpower)
- Overcurrent/Jam
- Undercurrent
- Current Unbalance
- Phase Loss
- Phase Reversal
- Overvoltage
- Undervoltage
- Voltage Unbalance
- Rapid Cycling/Jog
- Contactor Failure
- Zero-Sequence Ground Fault
- PTC Motor Overtemperature

## Littelfuse Mobile App





MP8000 Littelfuse App icon





**Specifications** 

#### **Functional Characteristics** Frequency **TC- Overcurrent Trip Class Output Characteristics Output Contact Rating Control relay Auxiliary relay Pilot Duty Rating General Purpose General Characteristics**

#### **Ambient Temperature Range**

Operating Storage Accuracy Voltage Current Timing

-40° to 70°C (-40° to 158°F) -55° to 80°C (-67° to 176°F)

50/60Hz

SPST - Form A

SPDT - Form C

5A @ 240VAC

B300

Trip class 02-60 or linear

±1% ±2% (2 to 100 amps direct) 2% ±0.5 seconds ±5%

#### **GF** Current Repeatability

Voltage Current **Maximum Input Power Pollution Degree Class of Protection Relative Humidity Terminal Torque (depluggable** terminal blocks) **Terminal Torque** (Earth Ground) **Standards Passed Radio Frequency Immunity** (RFI), Conducted **Radio Frequency Immunity** (RFI), Radiated **Fast Transient Burst** Surge

**FCC Rating** 

**Short Circuit Withstand** Rating **Hi-Potential Test Safety Marks** cULus CF **Maximum Conductor Size** (with insulation)

Weight **Mounting Method** 

Dimensions

±0.5% ±1% (2 to 100 amps direct) 3 (conformal coating standard)

IP20 10-95%, non-condensing per IEC 68-2-3

5.5 in.-lbs.

5 W

7.9 in.-lbs.

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air

IEC 61000-4-6, Level 3 10V/m

IEC 61000-4-3, Level 3 10V/m IEC 61000-4-4, Level 3, 3.5kV input power IEC 61000-4-5, Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground Part 15.107 for emissions, Part 15.247 for intentional radiators

100kA symmetrical at 690VAC Meets UL508 (2 x rated V +1000V for 1 minute)

UL60947, UL1053, C22.2 (File #E68520) IEC 60947 Edition 5.2, IEC 60947-8

0.63" H 73.91 mm (2.91"); W 103.63 mm (4.08"); D 121.67 mm (4.79") 0.85 lbs (13.6 oz, 385.6 g) Surface mount (4 - #8 screws) or DIN-rail mount

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# **777 SERIES**

## 3-Phase Current & Voltage Monitor



## Wiring Diagram

TYPICAL WIRING DIAGRAM FOR MODEL 777 (2 to 90 amps)



CURRENT TRANSFORMER WIRING DIAGRAM FOR MODEL 777 (80 to 800 amps)



#### **Description**

The 777 is a fully programmable electronic overload relay designed to protect any motor drawing 2-800 full load amps (external CTs are required above 90 amps). The 777 (family of products) is for 3-phase 200-480VAC applications, with several specialized units for other voltage ranges and unique applications. Common applications include conveyor systems, HVAC equipment, saws and grinders, fan motors, and almost any pumping application. Some unique applications include use with a Subtrol® equipped Franklin submersible motor to detect high motor temperatures and applications where a fast linear trip is required.

All of the overload relays provide unsurpassed protection by combining overload, voltage, phase loss and reversal, voltage and current unbalance, power monitoring, and underload based on current in one package. For standalone applications, the units incorporate a 3-digit LED display that is used for programming, providing real-time operational information and displaying diagnostic codes to aid in troubleshooting a fault condition. The units also feature a communications port that can be used with communication modules listed in the 777 accessories section to form a Modbus, DeviceNet<sup>™</sup>, Profibus, or Ethernet network. Up to 99 units can be remotely monitored and controlled from a PC, PLC, or SCADA system, and data logging through a PC with the optional Solutions software. This capability allows for a simple, cost-effective way to meet new requirements for arc-flash safety.

## Features & Benefits

FEATURES	BENEFITS
Built-in display	Visual indication for programming, viewing real-time voltage or current, and last fault code
Programmable voltage and current settings	Allows usage on wide range of systems
3 selectable restart options	Choose from automatic, semi-automatic, or manual to best meet individual application needs
3 programmable restart delay timers	Program separate restart delay time for rapid cycle protection, motor cool down, and dry-well recovery
Remote display compatibility	Increases safety through remote display of real-time data and fault history, without the need to open the cabinet. Aids with arc flash safety regulations
Flexible reset	Reset can be done through pushbutton on relay or remotely with optional 777-MRSW or OL-RESET remote reset kit
Network communications capability	Compatible with Modbus, DeviceNet™, Profibus, or Ethernet using optional communications module

#### **Ordering Information**

See next page.

For dimensional drawing see: Appendix page 507, Figure 1.

Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com



## **Ordering Information**

777 SERIES

MODEL	LINE VOLTAGE	MOTOR FULL AMP RANGE	DESCRIPTION
777-P2	200-480VAC	2-800A (external CTs required above 90A)	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts
777-LR-P2	200-480VAC	1-800A (external CTs required above 9A)	Protects low range motors when wired directly or with 10-800 FLA with use of external CTs
777-HVR-P2	340-480VAC	2-800A (external CTs required above 90A)	Provides low and high power trip*, linear overcurrent trip, and 470VA @ 600VAC output SPDT relay contacts. Required when a control power transformer (CPT) is not used with a 480V system
777-HVR-LR-P2	340-480VAC	1-800A (external CTs required above 9A)	Provides low and high power trip*, linear overcurrent trip, and 470VA @ 600VAC output SPDT relay contacts. Required when a control power transformer (CPT) is not used with a 480V system
777-575-P2	500-600VAC	2-800A (external CTs required above 90A)	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Used in Canada and NE USA where 575V utility power services are common
777-575-LR-P2	500-600VAC	1-800A (external CTs required above 9A)	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Used in Canada and NE USA where 575V utility power services are common
777-MV-P2	100-240VAC	10-800A with external CTs	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Designed for Medium Voltage applications where both PTs and CTs are used. Has built in multipliers for 25.5, 50.5, 100.5 CTs. The voltage unbalance, single-phase and reverse phase protection can be disabled for applications where only the PTs are used
777-HRG-P2	200-480VAC	2-90A only	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Designed for high resistance grounding systems that incorporate an external zero-sequence CT that correspond with the built in multipliers to detect ground faults
777-LR-HRG-P2	200-480VAC	10-800A (external CTs required, external	Overload relays designed for high resistance grounding systems that incorporate an external zero-sequence CTs that correspond with the built in multipliers to detect ground faults
777-575-HRG-P2	500-600VAC	2-90A only	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Used in Canada and NE USA where 575V utility power services are common. Designed for high resistance grounding systems that incorporate an external zero-sequence CT that correspond with the built in multipliers to detect ground faults
777-575-LR-HRG-P2	500-600VAC	10-800A with external CTs	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Used in Canada and NE USA where 575V utility power services are common. Designed for high resistance grounding systems that incorporate an external zero-sequence CT that correspond with the built in multipliers to detect ground faults
777-FT	200-480VAC	2-800A (external CTs required above 90A)	Provides linear overcurrent trip and 480VA @ 240VAC output SPDT relay contacts. Also known as shock relay, it is designed for fast linear trip applications. Overcurrent trip delay can be set ranging from less than 500ms - 70 seconds. Low trip delay is ideal in chain drive and drive linkage applications to prevent breaking in overload or jam situations. Other applications include sewage clarifiers, mixers, augers, and conveyors. Longer trip delay is ideal for motor test panels in rewind shops. Also includes adjustable motor acceleration time and overcurrent trip delay time when the faster linear trip mode is used
777-TS	200-480VAC	2-800A (external CTs required above 90A)	Provides 480VA @ 240VAC output SPDT relay contacts. For use with Subtrol® equipped Franklin submersible motors to detect high motor temperatures
777-LR-TS	200-480VAC	1-9A only	Provides 480VA @ 240VAC output SPDT relay contacts. For use with Subtrol® equipped Franklin submersible motors to detect high motor temperatures
777-575-TS	500-600VAC	2-800A (external CTs required above 90A)	Provides 480VA @ 240VAC output SPDT relay contacts. For use with Subtrol® equipped Franklin submersible motors with nominal 500-600VAC range to detect high motor temperatures
777VA-02	200-480VAC	2-800A (external CTs required above 90A)	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. Has restart delay 1 setpoints of 2-500 minutes and undercurrent trip delay setpoints of 2-60 minutes.
777VA-03	200-480VAC	2-800A (external CTs required above 90A)	Provides low and high power trip*, linear overcurrent trip, and 480VA @ 240VAC output SPDT relay contacts. For use with static and rotary single to 3-phase converters. High and low voltage trip feature only applies to the utility supplied power. Works well with unloaded phase converters because the relay ignores severely unbalanced voltages

\* Network programmable only

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www.littelfuse.com/777



**777 SERIES** 

#### Accessories



#### **RS485MS-2W Communication Module** Required to enable the Modbus communications function on Model 77X-type products.

CIO-MB/CIO-120-MB Communication Module Modbus-RTU interfaces capable of providing discrete control and monitoring of an overload relay over a Modbus network.



#### CIO-DN-P/CIO-120-DN-P **Communication Module**

DeviceNet<sup>™</sup> interfaces capable of providing discrete control and monitoring of motor starters, drives and other devices over a DeviceNet<sup>™</sup> network.



#### **CIO-777-PR Communication Module** Profibus interface capable of providing discrete control and monitoring of motor starters, drives and other devices over a Profibus network.



**CIO-EN (non-POE) Communication Module** Modbus-TCP and Modbus-RTU interface capable of providing discrete control and monitoring of an overload relay over a Modbus network.

#### **Communication Adapters**

 RS485-RS232–Converter with cable & plug RS485-USB-Converter with cable & plug RS232-USB-Converter Specifications match industry standard. **RM1000 Remote Monitor** 

MOTOR & PUMP PROTECTION

The RM1000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring for up to 16 devices.



#### **RM2000 Remote Monitor**

The RM2000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring with event storage and real-time clock for date and time stamp.



Solutions Software: Solutions-M Software features include data logging, real-time data monitoring and fault and event monitoring.



777-MRSW Manual Remote Reset Kit Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.



**OL-RESET Manual Remote Reset Kit** Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.

## **Specifications**

**Functional Characteristics** Frequency **TC- Overcurrent Trip Class** (777 Plus Series units) **TC- Overcurrent Trip Class** (77C, 777 non-Plus

#### **Output Characteristics**

Series units)

**Output Contact Rating** (SPDT - Form C) **Pilot duty rating General purpose** Pilot duty rating for HVR models **General Characteristics Ambient Temperature Range** Operating Storage Accuracy Voltage Current **GF** Current Timing (777 Plus Series units) ±0.5 second Timing (77C, 777 non-Plus Series units) Repeatability Voltage Current **Maximum Input Power Pollution Degree Class of Protection Relative Humidity Terminal Torque Standards Passed Radio Frequency Immunity** (RFI), Conducted **Radio Frequency Immunity** (RFI), Radiated **Fast Transient Burst Short Circuit** Surge IEC

ANSI/IEEE

**Hi-potential Test** Vibration

Shock

## 50/60Hz

02-60, J02-J60, L00-L60 or Off

5, 10, 15, 20, 30 (J prefix enables jam protection feature)

480VA @ 240VAC, B300 10A @ 240VAC

470VA @ 600VAC, B600

-20° to 70°C (-4° to 158°F) -40° to 80°C (-40° to 176°F)

±1% ±3%(<100 amps direct) ±15%

5% +1 second

half-sine pulse

±0.5% of nominal voltage ±1% (<100 amps direct) 10 W 3 IP20 10-95%, non-condensing per IEC 68-2-3 7 in.-lbs.

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air

IEC 61000-4-6, Level 3 10V/m

IEC 61000-4-3, Level 3 10V/m IEC 61000-4-4, Level 3, 3.5kV input power 100kA

61000-4-5, Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V +1000V for 1 minute) IEC 68-2-6, 10-55Hz, 1mm peak-to-peak, 2 hours, 3 axis IEC 68-2-27, 30g, 3 axis, 11ms duration,

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# 777 SERIES



#### **Safety Marks**

Weight

**Mounting Method** 

UL CE CSA Maximum Conductor Size (with insulation) through 777/77C Dimensions UL508, UL1053 (File #E68520) IEC 60947-1, IEC 60947-5-1 C22.2 No. 14

0.65" **H** 77.47 mm (3.05"); **W** 97.79 mm (3.85"); **D** 128.27 mm (5.05") 1.56 lbs. (24.96 oz., 707.6 g) Surface mount (4 - #8 screws) or DIN rail mount

# 777 / 77C SERIES

## Single-Phase Current & Voltage Monitor





## Wiring Diagram

TYPICAL WIRING DIAGRAM FOR MODEL 77C WITH MOTOR CONTROL



#### TYPICAL WIRING DIAGRAM FOR MODEL 77C WITH EXTERNAL CT



For dimensional drawing see: Appendix page 507, Figure 1.

The 777/ 77C Series is a fully programmable electronic overload relay designed to protect any motor drawing 2-800 full load amps (external CTs are required above 90 amps). Common applications include conveyor systems, HVAC equipment, saws and grinders, fan motors, and almost any pumping application.

All of the overload relays provide unsurpassed protection by combining overload, underload, and voltage in one package. For standalone applications, the units incorporate a 3-digit LED display that is used for programming, providing real-time operational information and displaying diagnostic codes to aid in troubleshooting a fault condition. The units also feature a communications port that can be used with communication modules listed in the 777 accessories section to form a Modbus, DeviceNet<sup>™</sup>, Profibus, or Ethernet network. Up to 99 units can be remotely monitored and controlled from a PC, PLC, or SCADA system, and data logging through a PC with the optional Solutions software. This capability allows for a simple, cost-effective way to meet new requirements for arc-flash safety.

## Features & Benefits

FEATURES	BENEFITS
Built-in display	Visual indication for programming, viewing real-time voltage or current, and last fault code
Programmable voltage and current settings	Allows usage on wide range of systems
3 selectable restart options	Choose from automatic, semi-automatic, or manual to best meet individual application needs
3 programmable restart delay timers	Program separate restart delay time for rapid cycle protection, motor cool down, and dry-well recovery
Remote display compatibility	Increases safety through remote display of real-time data and fault history, without the need to open the cabinet. Aids with arc flash safety regulations
Flexible reset	Reset can be done through pushbutton on relay or remotely with optional 777-MRSW or OL-RESET remote reset kit
Network communications capability	Compatible with Modbus, DeviceNet™, Profibus, or Ethernet using optional communications module

## **Ordering Information**

MODEL	LINE VOLTAGE	MOTOR FULL AMP RANGE	DESCRIPTION
77C	100-240VAC	2-800A (external CTs required above 90A)	Provides 480VA @ 240VAC output SPDT relay contacts
77C-LR	100-240VAC	1-9A only	Provides 480VA @ 240VAC output SPDT relay contacts
777- HVR-SP	340-480VAC	2-800A (external CTs required above 90A)	Provides 470VA @ 600VAC output SPDT relay contacts. For systems with no control power transformer

777 / 77C SERIES

#### Accessories



#### **RS485MS-2W Communication Module** Required to enable the Modbus communications function on Model 77X-type products.



#### **Communication Adapters**

• RS485-RS232-Converter with cable & plug

- RS485-USB-Converter with cable & plug
- RS232-USB-Converter Specifications match industry standard.



#### RM1000 Remote Monitor The RM1000/777 motor management system

combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring for up to 16 devices.



#### **RM2000 Remote Monitor** The RM2000/777 motor management system combines unsurpassed electronic motor

protection and critical, user-friendly, motor monitoring with event storage and real-time clock for date and time stamp.



Solutions Software: Solutions-M Software features include data logging, real-time data monitoring and fault and event monitoring.



#### 777-MRSW Manual Remote Reset Kit Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.



**OL-RESET Manual Remote Reset Kit** Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.

## Specifications

#### Frequency **Functional Characteristics TC- Overcurrent Trip Class** (77C, 777 non-Plus Series units)

#### **Output Characteristics**

**Output Contact Rating** (SPDT - Form C) Pilot duty rating General purpose **Pilot duty rating for HVR** models **General Characteristics** Ambient Temperature Range Operating Storage Accuracy Voltage Current **GF** Current Timing (77C, 777 non-Plus Series units) Repeatability Voltage Current **Maximum Input Power Pollution Degree Class of Protection Relative Humidity Terminal Torque Standards Passed** Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air **Radio Frequency Immunity** (RFI), Conducted **Radio Frequency Immunity** (RFI), Radiated

50/60Hz

5, 10, 15, 20, 30 (J prefix enables jam protection feature)

Answers Delivered

480VA @ 240VAC, B300 10A @ 240VAC

470VA @ 600VAC, B600

-20° to 70°C (-4° to 158°F) -40° to 80°C (-40° to 176°F)

±1% ±3%(<100 amps direct) ±15%

5% +1 second

±0.5% of nominal voltage ±1% (<100 amps direct) 10 W 3 IP20 10-95%, non-condensing per IEC 68-2-3 7 in.-lbs.

C62.41 Surge and Ring Wave Compliance to a

Meets UL508 (2 x rated V +1000V for 1 minute)

IEC 68-2-6, 10-55Hz, 1mm peak-to-peak,

IEC 68-2-27, 30g, 3 axis, 11ms duration,

H 77.47 mm (3.05"); W 97.79 mm (3.85");

Surface mount (4 - #8 screws) or DIN rail mount

UL508, UL1053 (File #E68520)

IEC 60947-1, IEC 60947-5-1

**D** 128.27 mm (5.05")

1.56 lbs. (24.96 oz., 707.6 g)

IEC 61000-4-6, Level 3 10V/m IEC 61000-4-3, Level 3 10V/m **Fast Transient Burst** IEC 61000-4-4, Level 3, 3.5kV input power **Short Circuit** 100kA 61000-4-5, Level 3, 2kV line-to-line; Level 4,

4kV line-to-ground

2 hours, 3 axis

half-sine pulse

C22.2

0.65"

level of 6kV line-to-line

ANSI/IEEE

Surge IEC

**Hi-potential Test** 

Vibration

Shock

#### **Safety Marks**

UL CE CSA **Maximum Conductor Size** (with insulation) through 777/77C Dimensions

Weight **Mounting Method** 

www.littelfuse.com/777-77c

Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

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## Protection Relays Motor and Pump Protection – 3-Phase Pump Protection

# 777-KW/HP-P2 SERIES

## 3-Phase Current & Voltage Monitor





## Wiring Diagram

TYPICAL WIRING DIAGRAM FOR 777-KW/HP-P2 SERIES



CURRENT TRANSFORMER WIRING DIAGRAM FOR 777-KW/HP-P2 SERIES



make 5 passes through the corresponding main conductor window.

For dimensional drawing see: Appendix page 507, Figure 1.

## Description

The 777-KW/HP-P2 Series has the overload, voltage, phase loss and reversal, voltage and current unbalance, current and power monitoring\*, and underload trip based on power in one package. The underpower trip feature is desirable anytime the current vs. load characteristic is non-linear or has little change. In general terms, smaller motors and slow-speed motors have little change in current over the normal load range. Larger motors that are running light loads will also show small current changes over the operating load range. For standalone applications, the units incorporate a 3-digit LED display that is used for programming, providing real-time operational information and displaying diagnostic codes to aid in troubleshooting a fault condition.



The units also feature a communications port that can be used with communication modules listed in the 777 accessories section to form a Modbus, DeviceNet<sup>™</sup>, Profibus, or Ethernet network. Up to 99 units can be remotely monitored and controlled from a PC, PLC, or SCADA system, and data logging through a PC with the optional Solutions software.

\* Low current trip and high power trip are network programmable only

#### Features & Benefits

FEATURES	BENEFITS
Low and High Power Protection	Increases reliability for non-linear motors where the load characteristic has little change
Built-in Display	Visual indication for programming, viewing real-time voltage, current, kilowatts, or horsepower, and last fault code
Programmable voltage and current settings	Allows usage on wide range of systems
3 selectable restart options	Choose from automatic, semi-automatic, or manual to best meet individual application needs
3 programmable restart delay timers	Program separate restart delay time for rapid cycle protection, motor cool down, and dry-well recovery
Remote display compatibility	Increases safety through remote display of real-time data and fault history, without the need to open the cabinet. Aids with arc flash safety regulations
Flexible reset	Reset can be done through pushbutton on relay or remotely with optional 777-MRSW or OL-RESET remote reset kit
Network	Compatible with Madhua DaviasNatIM Profibus or

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# 777-KW/HP-P2 SERIES



#### **Ordering Information**

MODEL	LINE VOLTAGE	MOTOR FULL AMP RANGE	DESCRIPTION
777-KW/HP-P2	200-480VAC (3-phase)	2-800A (external CTs required above 90A)	Provides 480VA @ 240VAC output SPDT relay contacts
777-LR-KW/HP-P2	200-480VAC (3-phase)	1-800A (external CTs required above 9A)	Provides 480VA @ 240VAC output SPDT relay contacts
777-HVR-KW/HP-P2	340-480VAC (3-phase)	2-800A (external CTs required above 90A)	Provides 470VA @ 600VAC output SPDT relay contacts. Required when a CPT (control power transformer) is not used on a 480V system. Commonly used in pumping applications to save the cost and extra wiring associated with a CPT
777-575-KW/HP-P2	500-600VAC (3-phase)	2-800A (external CTs required above 90A)	Provides 480VA @ 240VAC output SPDT relay contacts. Used in Canada and NE USA where 575V utility power services are common
777-MLR-KW/HP-P2	200-480VAC (3-phase)	0.5-21A and 40-740A with external CTs	Provides 480VA @ 240VAC output SPDT relay contacts. It is wired directly without the need to loop conductors for 5-21 amps (under 5 amps requires looping of conductors), and can be used with external CTs for 40-740 amps

#### Accessories



#### RS485MS-2W Communication Module

Required to enable the Modbus communications function on Model 77X-type products.



#### **CIO-MB/CIO-120-MB Communication Module** Modbus-RTU interfaces capable of providing discrete control and monitoring of an overload relay over a Modbus network.



#### CIO-DN-P/CIO-120-DN-P Communication Module

DeviceNet<sup>™</sup> interfaces capable of providing discrete control and monitoring of motor starters, drives and other devices over a DeviceNet<sup>™</sup> network.



**CIO-777-PR Communication Module** Profibus interface capable of providing discrete control and monitoring of motor starters, drives and other devices over a Profibus network.



**CIO-EN (non-POE) Communication Module** Modbus-TCP and Modbus-RTU interface capable of providing discrete control and monitoring of an overload relay over a Modbus network.



#### Communication Adapters

- RS485-RS232-Converter with cable & plug
- RS485-USB-Converter with cable & plug
- **RS232-USB**–Converter Specifications match industry standard.



#### **RM1000 Remote Monitor**

The RM1000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring for up to 16 devices.



#### **RM2000 Remote Monitor** The RM2000/777 motor management system

combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring with event storage and real-time clock for date and time stamp.



#### **Solutions Software: Solutions-M** Software features include data logging, real-time

data monitoring and fault and event monitoring.



#### **777-MRSW Manual Remote Reset Kit** Allows the 777 line of MotorSaver<sup>®</sup> and

Allows the /// line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.



**OL-RESET Manual Remote Reset Kit** Allows the 777 line of MotorSaver<sup>®</sup> and PumpSaver<sup>®</sup> products to be manually reset without opening the panel door.

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## 777-KW/HP-P2 SERIES

#### **Specifications**

Frequency **Functional Characteristics TC-Overcurrent Trip Class Output Characteristics Output Contact Rating** (SPDT - Form C) Pilot duty rating **General purpose Pilot duty rating for HVR** model **General Characteristics Ambient Temperature Range** Operating Storage Accuracy Voltage Current Power **GF** Current Timing Repeatability Voltage Current Power **Maximum Input Power Pollution Degree Class of Protection Relative Humidity Terminal Torque Standards Passed** 

Electrostatic Discharge (ESD) Radio Frequency Immunity (RFI), Conducted Radio Frequency Immunity (RFI), Radiated Fast Transient Burst Short Circuit Rating 50/60Hz

02-60, J02-J60, L00-L60 or OFF

480VA @ 240VAC, B300 10A @ 240VAC

470VA @ 600VAC, B600

-20° to 70°C (-4° to 158°F) -40° to 80°C (-40° to 176°F)

±1% ±3% (<100 amps direct) ±4% (<100 amps direct) ±15% ±0.5 second

±0.5% of nominal voltage ±1% (<100 amps direct) ±2% 10 W 3 IP20 10-95%, non-condensing per IEC 68-2-3 7 in.-lbs.

IEC 61000-4-2, Level 3, 6kV contact, 8kV air

IEC 61000-4-6, Level 3 10V/m

IEC 61000-4-3, Level 3 10V/m IEC 61000-4-4, Level 3, 3.5 kV input power 100kA Surge IEC

ANSI/IEEE

Hi-potential Test

Vibration

Shock

Safety Marks UL CE CSA Maximum Conductor Size (with insulation) through 777 Dimensions

Weight Mounting Method 61000-4-5, Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V +1000V for 1 minute) IEC 68-2-6, 10-55Hz, 1mm peak-to-peak, 2 hours, 3 axis IEC 68-2-27, 30g, 3 axis, 11ms duration, half-sine pulse

UL508, UL1053 (File #E68520) IEC 60947-1, IEC 60947-5-1 C22.2 No. 14

0.65" **H** 77.47 mm (3.05"); **W** 97.79 mm (3.85"); **D** 128.27 mm (5.05") 1.56 lbs. (24.96 oz., 707.6 g) Surface mount (4 - #8 screws) or DIN rail mount

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# 777-ACCUPOWER

## 3-Phase Current & Voltage Monitor





#### **Wiring Diagram**

TYPICAL WIRING DIAGRAM FOR MODEL 777-ACCUPOWER



CURRENT TRANSFORMER WIRING DIAGRAM OR MODEL 777-ACCUPOWER



For dimensional drawing see: Appendix page 507, Figure 1.

The 777-AccuPower is a fully-programmable 3-phase motor and pump protection relay. It allows motor hp rating, full load amps, efficiency and power factor to be entered and will accurately calculate motor output power. This is most useful with mag-drive pumps or process applications where the process power is desired over the utility power. Voltage, current and power measurements can be displayed as well as fault information and setpoints. The built-in display simplifies troubleshooting and allows the user to easily and precisely configure setpoints. The 777-AccuPower can be used with the optional COM 4-20 output module to give an analog signal proportional to output shaft power, the RS485MS-2W (for limited Modbus capabilities, and for use with the RM1000/RM2000) remote displays listed in the 777 accessories section.

## Features & Benefits

FEATURES	BENEFITS
Motor output power measurement	Allows use of process power over utility power
3 programmable restart delay timers	Program separate restart delay time for rapid cycle protection, motor cool down, and dry-well recovery
Built-in Display	Visual indication for programming, viewing real-time voltage or current, and last fault code
Remote display compatibility	Increases safety through remote display of run-hour meter, last four fault codes, without the need to open the cabinet. Aids with arc flash safety regulations
Network communications capability	Limited Modbus capabilities using RS485MS-2W communication module

## Accessories



RS485MS-2W Communication Module

Required to enable the Modbus communications function on Model 77X-type products.



## **COM 4-20 Output Communication Module**

This module allows communication to a PLC with an analog input and no Modbus input.



**RM1000 Remote Monitor** The RM1000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor

# monitoring for up to 16 devices **RM2000 Remote Monitor**

The RM2000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring with event storage and real-time clock for date and time stamp.



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777-ACCUPOWER

## Protection Relays Motor and Pump Protection – 3-Phase Pump Protection

#### Specifications

Input Characteristics Line Voltage Frequency Motor Full Load Amp Range Functional Characteristics TC- Overcurrent Trip Class

#### **Output Characteristics**

Output Contact Rating (SPDT - Form C) Pilot duty General Purpose

#### General Characteristics Ambient Temperature Range

Operating Storage Accuracy **Measured Horsepower/** Kilowatt Typical Voltage Current **GF** Current Timing Repeatability Voltage Current **Maximum Input Power Pollution Degree Class of Protection Relative Humidity Terminal Torque** 

200-480VAC 50/60Hz 2-800A (external CTs required over 90A)

5, 10, 15, 20, 30 (J prefix enables jam protection feature)

480VA @ 240VAC 10A @ 240VAC

-40° to 70°C (-40° to 158°F) -40° to 80°C (-40° to 176°F)

±3%\* ±1% ±3%(<100 amps direct) ±15% 5% ±1 second

±0.5% of nominal voltage ±1% (<100 amps direct) 10 W 3 IP20, NEMA 1 (finger safe) 10-95%, non-condensing per IEC 68-2-3 7 in.-Ibs.

#### Standards Passed

Electrostatic Discharge (ESD) Radio Frequency Immunity (RFI), Conducted Radio Frequency Immunity (RFI), Radiated Fast Transient Burst Short Circuit Rating Surge IEC

#### ANSI/IEEE

Hi-Potential Test

Vibration

Shock

Safety Marks UL CE CSA Max. Conductor Size through 777 Dimensions

Weight Mounting Method IEC 61000-4-2, Level 3, 6kV contact, 8kV air

IEC 61000-4-6, Level 3 10V/m

IEC 61000-4-3, Level 3 10V/m IEC 61000-4-4, Level 3, 3.5 kV input power 100kA

61000-4-5 Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V + 1000V for 1 min.) IEC 68-2-6, 10-55Hz, 1mm peak-to-peak, 2 hrs, 3 axis IEC 68-2-27, 30g, 3 axis, 11ms duration, half-sine pulse

UL508, UL1053 IEC 60947-1, IEC 60947-5-1 C22.2

0.65" with insulation **H** 77.47 mm (3.05"); **W** 97.79 mm (3.85"); **D** 128.27 mm (5.05") 1.3 lbs. (20.8 oz., 589.67 g) Surface mount (4 - #8 screws) or DIN rail mount

\*On a well balanced system within recommended current range.

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# 77C-KW/HP SERIES

## Single-Phase Current & Voltage Monitor



## Wiring Diagram



TYPICAL WIRING DIAGRAM FOR MODEL 77C-KW/HP WITH EXTERNAL CT



For dimensional drawing see: Appendix page 507, Figure 1.

## Description

The 77C-KW/HP and 77C-LR-KW/HP are fully programmable pump protection relays which will monitor the voltage and current for high or low voltage, overload and underload conditions based on power, in one package. The underpower trip feature is desirable anytime the current vs.load characteristic is non-linear or has little change. In general terms, smaller motors and slow-speed motors have little change in current over the normal load range. Larger motors that are running light loads will also show small current changes over the operating load range. Common uses include pumping applications where motors run slower than around 3400 rpm and usually have small current vs load changes; such as slow speed mixer or agitator motors up to 50 hp, and magdrive or can pumps.



The Littelfuse PumpSaver relay provides the high sensivity of a power monitor to protect pump motors from dry run and dead-head conditions.

## Features & Benefits

FEATURES	BENEFITS
Underload protection	Increases reliability for non-linear motors where the load characteristic has little change
Built-in display	Visual indication for programming, viewing real-time voltage, current, kilowatts or horsepower, and last fault code
15 programmable criteria settings	Allows user flexibility to fine-tune the relay for maximum protection in any application.
Last fault memory	Provides instant troubleshooting diagnostics
Remote display compatibility	Increases safety through remote display of real-time data and fault history, without the need to open the cabinet. Aids with arc flash safety regulations.
Flexible reset	Reset options: automatic, manual using pushbutton on relay, or remotely with optional 777-MRSW or OL-RESET remote reset kit.
Network communications capability	Compatible with Modbus using optional communications module (RS485MS-2W)

## Ordering Information

MODEL	LINE VOLTAGE	MOTOR FULL AMP RANGE	DESCRIPTION
77C-KW/HP	100-240VAC	2-90A (external CTs required above 90A)	Provides 480VA @ 240VAC output SPDT (Form C) relay contacts
77C-LR-KW/HP	100-240VAC	1-9A (external CTs required above 9A)	Provides 480VA @ 240VAC output SPDT (Form C) relay contacts



# 77C-KW/HP SERIES

## Accessories



#### **RS485MS-2W Communication Module**

Required to enable the Modbus communications function on Model 77X-type products.

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#### **Communication Adapters** • RS485-RS232-Converter with cable & plug

• RS485-USB-Converter with cable & plug RS232-USB-Converter Specifications match industry standard.



#### **RM1000 Remote Monitor**

The RM1000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring for up to 16 devices.



#### **RM2000 Remote Monitor**

The RM2000/777 motor management system combines unsurpassed electronic motor protection and critical, user-friendly, motor monitoring with event storage and real-time clock for date and time stamp.



Solutions Software: Solutions-M Software features include data logging, real-time data monitoring and fault and event monitoring.



777-MRSW Manual Remote Reset Kit Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.



#### **OL-RESET Manual Remote Reset Kit** Allows the 777 line of MotorSaver® and PumpSaver® products to be manually reset without opening the panel door.

## **Specifications**

#### **Input Characteristics**

Supplt Voltage Frequency **Motor Full Load Amp Range** 77C-KW/HP

#### 77C-LR-KW/HP

**Short Circuit Withstand** Rating **Power Consumption Output Contact Rating SPDT** (Form C)

**Expected Life** Mechanical Electrical Accuracy at 25° C (77° F) Voltage Current Timing Repeatability Voltage Current **Safety Marks** UL CE CSA

#### **Standards Passed**

**Radio Frequency Immunity** (RFI), Conducted **Radio Frequency Immunity** (RFI), Radiated **Fast Transient Burst** Surge IEC

#### **ANSI/IEEE**

**Hi-potential Test** Vibration

Shock

#### Mechanical Dimensions

**Maximum conductor** size through holes **Terminal Torque Enclosure Material** Weight **Mounting Methods** 

100-240 VAC, 1Ø 50-60 Hz

2-25 Amps (Loops Required) 26-90 Amps (Direct) 91-800 Amps (External CT's) 1.0 Amps - 2.0 Amps (additional Loop) 2.0 Amps - 9.0 Amps (Direct)

100kA per UL and CSA 5W (Maximum)

Pilot duty rating: 480 VA @ 240 VAC General purpose: 10A @ 240 VAC

1 x 10<sup>6</sup> operations 1 x 10<sup>5</sup> operations at rated load

±1% ±3% (Direct, No External CTs) 5% ± 1 second

± 0.5% of nominal voltage ± 1% (Direct, No External CTs)

UL508, UL1053 IEC 60947-1, IEC 60947-5-1 C22.2 No. 14

Electrostatic Discharge (ESD) IEC 61000-4-2, Level 3, 6kV contact, 8kV air

IEC 61000-4-6, Level 3 10V/m

IEC 61000-4-3, Level 3 10V/m IEC 61000-4-4, Level 3, 3.5kV input power

IEC 61000-4-5, Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground C62.41 Surge and Ring Wave compliance to a level of 6kV line-to-line Meets UL508 (2 x rated V +1000V for 1 min.) IEC 68-2-6, 10-55Hz, 1mm peak-to-peak, 2 hours, 3 axis IEC 68-2-27, 30g, 3 axis, 11ms duration, half-sine pulse

H 77.47 mm (3.05"); W 97.79 mm (3.85"); D 128.27 mm (5.05")

0.65" (with insulation) 7 in.-lbs. polycarbonate 1.2 lbs 35mm DIN rail or surface mount

# 77C-KW/HP SERIES



#### **Environmental**

Temperature Range				
Ambient Operating	-20° - 70° C (-4° - 158°F)			
Ambient Storage	-40° - 80° C (-40° - 176°F)			
Pollution Degree	3			
Class of Protection	IP20, NEMA 1			
Relative Humidity	10-95%, non-condensing per IEC 68-2-3			
Programmable				
Operating Points	Range			
LV- Low Voltage Threshold	85V - HV Setting			
HV- High Voltage Threshold	LV Setting - 264V			
MULT- # of Conductors or				
CT Ratio (XXX:5)				
77C:	1-10 Conductors or 100-800 Ratio			
77C-LR:	1 or 2			
OC- Overcurrent Threshold	(20-100A) ÷ MULT or 80-120% of CT Primary			
TC- Overcurrent Trip Class *	5, J5, 10, J10, 15, J15, 20, J20, 30, J30, or			
RD1- Rapid Cycle Timer	0, 2 - 500 Seconds			
RD2- Restart Delay After All				
Faults Except Undercurrent				
(motor cool down timer)**	2 - 500 Minutes/Seconds			
RD3- Restart Delay				
After Undercurrent				
(dry well recovery timer)	2 - 500 Minutes/Sec	onds		
#RU- Number of Restarts				
After Undercurrent	0, 1, 2, 3, 4, A (Automatic)			
ADDR- RS485 Address	A01- A99			
#RO-Number of Restarts				
After Overcurrent	0, 1, 2, 3, 4, A (Automatic)			
LP/PWS (PWS = LP Range)	<b>1</b> = 0.01 - 0.99 KW <b>2</b> = 1.00 - 9.95 KW <b>3</b> = 10.0 - 99.5 KW <b>4</b> = 100 - 650 KW	5 = 0.01 - 1.30 HP 6 = 1.34 - 13.3 HP 8 = 13.4 - 133 HP 9 = 134 - 871 HP		

\* If J Prefix is displayed in trip class setting, jam protection is enabled. If programmed to LIn position, overcurrent trip delays are fixed linear-type delays set in OPT1 position.

\*\* RD2 & RD3 can be changed from minutes to seconds under program position OPT2.

SETTING	RD2	RD3	SETTING	RD2	RD3
0	Minutes	Minutes	2	Seconds	Minutes
1	Minutes	Seconds	3	Seconds	Seconds