

# Application Control Guidelines



IntelliROL<sup>®</sup> Power Supply<sup>™</sup>

P/N 1176718

Revision Date: February 17, 2021



# TABLE OF CONTENTS

---

<b>LIST OF TABLES .....</b>	<b>3</b>
1.1: MHS Conveyor SAFETY RECOMMENDATION .....	4
<b>CHAPTER 2: WARNINGS AND SAFETY INSTRUCTIONS .....</b>	<b>6</b>
<b>CHAPTER 3: INTRODUCTION .....</b>	<b>7</b>
3.1: OVERVIEW .....	7
<b>CHAPTER 4: MHS Conveyor PARTS LIST .....</b>	<b>8</b>
<b>CHAPTER 5: FEATURES .....</b>	<b>11</b>
5.1: ALL INTELLIROL POWER SUPPLIES .....	11
5.2: POWER SUPPLY FEATURES .....	12
5.3: DIAGNOSTIC RELAY .....	13
5.4: TERMINAL STRIP CONNECTIONS .....	14
<b>CHAPTER 6: ITR COMBINATION POWER SUPPLIES .....</b>	<b>15</b>
<b>CHAPTER 7: CONNECTIONS .....</b>	<b>17</b>
7.1: INTERNAL TO POWER SUPPLY .....	17
7.2: AT CONVEYOR EQUIPMENT .....	18
<b>CHAPTER 8: APPLICATION .....</b>	<b>19</b>
<b>CHAPTER 9: STATUS INDICATORS .....</b>	<b>20</b>
<b>CHAPTER 10: TROUBLESHOOTING GUIDE .....</b>	<b>21</b>
10.1: INTELLIROL STANDARD AND COMBINATION POWER SUPPLIES .....	21
10.2: INTELLIROL COMBINATION POWER SUPPLIES .....	23
<b>CHAPTER 11: SPECIFICATIONS .....</b>	<b>26</b>
11.1: ITR STANDARD AND COMBINATION (480VAC INPUT) .....	26
11.2: ITR STANDARD AND COMBINATION (208/240VAC INPUT) .....	27
11.3: ITR STANDARD AND COMBINATION (120VAC INPUT) .....	28
11.4: CLASS 2 PROTECTION MODULE .....	29
11.5: CRUZCONTROL TECHNICAL DATA .....	30
<b>WORKS CITED .....</b>	<b>31</b>
MHS Conveyor GENERAL INFORMATION .....	31
<b>MHS Conveyor INFORMATION .....</b>	<b>32</b>

## LIST OF TABLES

---

Table 1: IntelliROL Power Supply Listing .....	8
Table 2: IntelliROL Standard Power Supply Status Indicators .....	20
Table 3: IntelliROL Combination Power Supply Status Indicators .....	20
Table 4: IntelliROL Standard and Combination Power Supply Troubleshooting Guide .....	21
Table 5: IntelliROL Combination Power Supply Troubleshooting Guide .....	23
Table 6: IntelliROL Standard and Combination Power Supplies (480VAC Input).....	26

## 1.1: MHS Conveyor SAFETY RECOMMENDATION

### MHS Conveyor Equipment Warranty

MHS Conveyor warrants that the material and workmanship entering into its equipment is merchantable and will be furnished in accordance with the specifications stated.

MHS Conveyor agrees to furnish the purchaser without charge any part proved defective within 2 years from date of shipment provided the purchaser gives MHS Conveyor immediate notice in writing and examination proves the claim that such materials or parts were defective when furnished. For drive components specific to XenoROL® (i.e. Xeno belts, slave Xeno belts, drive spools, standard and speed-up, and spacers), this warranty shall be extended to five years of running use, provided the conveyors are applied, installed and maintained in accordance with MHS Conveyor published standards. Other than the above, there are no warranties which extend beyond the description on the face hereof. Consequential damages of any sort are wholly excluded.

The liability of MHS Conveyor will be limited to the replacement cost of any defective part. All freight and installation costs relative to any warranted part will be at the expense of the purchaser. Any liability of MHS Conveyor under the warranties specified above is conditioned upon the equipment being installed, handled, operated, and maintained in accordance with the written instructions provided or approved in writing by MHS Conveyor.

The warranties specified above do not cover, and MHS Conveyor makes no warranties which extend to, damage to the equipment due to deterioration or wear occasioned by chemicals, abrasion, corrosion or erosion; Purchaser's misapplication, abuse, alteration, operation or maintenance; abnormal conditions of temperature or dirt; or operation of the equipment above rated capacities or in an otherwise improper manner.

THERE ARE NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, EXTENDING BEYOND THOSE SET FORTH IN THIS STATEMENT OF WARRANTY.

Rev 03/01/2019



### MHS Conveyor Environment Standards

MHS Conveyor equipment is designed to be installed in a clean, dry warehouse environment. Exposure to extreme humidity, direct sunlight, blowing dirt or rain can permanently damage some components of MHS conveyor. In particular, the curing agents in concrete are known to attack and degrade the urethane conveyor components.

When installing conveyor on a new construction site, be sure that the concrete is properly cured before setting conveyor on it. In addition, if conveyors are stored in the proximity of curing concrete, proper ventilation must be used to direct the curing agent fumes away from the conveyor.

Failure to comply with these guidelines will void the MHS Conveyor warranty on any failed components that result from these environment issues.

03/01/2019

 <b>WARNING</b>	
	<ul style="list-style-type: none"> <li>• Safety: Always lock out power source and follow recommended safety procedures.</li> </ul>

## Chapter 2: WARNINGS AND SAFETY INSTRUCTIONS

Failure to follow the instructions and cautions throughout this manual and warning label on the conveyor may result in injury to personnel or damage to the equipment.

Your MHS Conveyor conveyor is powered by a motor and can be stopped only by turning off electrical power to the motor. As with all powered machinery, the drive-related components – including sprockets, chains, shafts, universal joints, and pneumatic devices – can be dangerous. We have installed or provided guards to prevent accidental contact with these parts, along with warning labels to identify the hazards.

Special attention must be paid to the following areas of this manual:



### WARNING



- Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

### CAUTION

- Indicates a situation, which, if not avoided, could result in property damage.

## Chapter 3: INTRODUCTION

---

### 3.1: OVERVIEW

The IntelliROL product line includes power supplies that convert various AC power sources to 24VDC power sources. These power supplies are used to supply power to the motorized roller components included in our IntelliROL product line. Power supplies are available for most standard input voltages. Available output currents include 10, 20, 40 and 80 amperes.

IntelliROL power supplies are available with internal branch circuit protection. If branch circuit protection is already provided upstream by others, IntelliROL power supplies are available without internal branch circuit protection at a lower cost. All IntelliROL power supplies are designed and built to UL508A standards. Refer to Table 1: IntelliROL Power Supply Listing for a list of available power supplies.

# Chapter 4: MHS Conveyor PARTS LIST

**Table 1: IntelliROL Power Supply Listing**

24VDC STANDARD POWER SUPPLIES WITH BRANCH CIRCUIT PROTECTION FOR INTELLIROL									
Item Number	Drawing Number	Input Voltage	Power Supply Size	Input Current	Output Current	Number of MDR	Enclosure Type	UL Listed	Enclosure Dimensions (H x W x D)
1176603	130E233	480VAC/3PH/60HZ	80A	2.8A	80A	36	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160913	130E115	480VAC/3PH/60HZ	40A	1.4A	40A	18	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160948	130E117	240VAC/3PH/60HZ	40A	4.5A	40A	18	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160950	130E119	120VAC/1PH/60HZ	40A	8.6A	40A	18	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160915	130E116	480VAC/3PH/60HZ	20A	0.65A	20A	9	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160949	130E118	240VAC/3PH/60HZ	20A	2.23A	20A	9	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160951	130E120	120VAC/1PH/60HZ	20A	4.64A	20A	9	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1166694	130E174	480VAC/3PH/60HZ	10A	0.6A	10A	3	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1166695	130E175	240VAC/2PH/60HZ	10A	1.13A	10A	3	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1166696	130E176	120VAC/1PH/60HZ	10A	2.15A	10A	3	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"

24VDC STANDARD POWER SUPPLIES WITHOUT BRANCH CIRCUIT PROTECTION FOR INTELLIROL									
Item Number	Drawing Number	Input Voltage	Power Supply Size	Input Current	Output Current	Number of MDR	Enclosure Type	UL Listed	Enclosure Dimensions (H x W x D)
1176628	130E234	480VAC/3PH/60HZ	80A	2.8A	80A	36	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1159645	130E121	480VAC/3PH/60HZ	40A	1.4A	40A	18	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160953	130E123	240VAC/2PH/60HZ	40A	4.5A	40A	18	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160955	130E125	120VAC/1PH/60HZ	40A	8.6A	40A	18	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1159647	130E122	480VAC/3PH/60HZ	20A	0.65A	20A	9	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160954	130E124	240VAC/2PH/60HZ	20A	2.23A	20A	9	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160956	130E126	120VAC/1PH/60HZ	20A	4.64A	20A	9	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1166697	130E177	480VAC/3PH/60HZ	10A	0.6A	10A	3	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1166698	130E178	240VAC/2PH/60HZ	10A	1.13A	10A	3	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1166699	130E179	120VAC/1PH/60HZ	10A	2.15A	10A	3	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"

24VDC COMBINATION POWER SUPPLIES WITH BRANCH CIRCUIT PROTECTION FOR INTELLIROL AND CRUZCONTROL										
Item Number	Drawing Number	Input Voltage	Power Supply Size	Input Current	Output Current		Number of MDR	Enclosure Type	UL Listed	Enclosure Dimensions (H x W x D)
					ITR	CRUZ				
1160917	130E103	480VAC/3PH/60HZ	40A	1.4A	36	4	17	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160919	130E105	240VAC/2PH/60HZ	40A	4.5A	36	4	17	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160921	130E107	120VAC/1PH/60HZ	40A	8.6A	36	4	17	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160918	130E104	480VAC/3PH/60HZ	20A	0.65A	16	4	8	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160920	130E106	240VAC/2PH/60HZ	20A	2.23A	16	4	8	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160922	130E108	120VAC/1PH/60HZ	20A	4.64A	16	4	8	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1166700	130E180	480VAC/3PH/60HZ	10A	0.6A	6	4	2	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1166701	130E181	240VAC/2PH/60HZ	10A	1.13A	6	4	2	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1166702	130E182	120VAC/1PH/60HZ	10A	2.15A	6	4	2	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
Combination power supplies split the output current between the MDR supply and the Class 2 supply. The Class 2 supply can use up to 3.7A, in which case the MDR supply would have 36.3A available from a 40A supply.										



**24VDC COMBINATION POWER SUPPLIES WITHOUT BRANCH CIRCUIT PROTECTION FOR INTELLIROL AND CRUZCONTROL**

Item Number	Drawing Number	Input Voltage	Power Supply Size	Input Current	Output Current		Number of MDR	Enclosure Type	UL Listed	Enclosure Dimensions (H x W x D)
					IT R	CRU Z				
1160923	130E109	480VAC/3PH/60HZ	40A	1.4A	36	4	17	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160925	130E111	240VAC/2PH/60HZ	40A	4.5A	36	4	17	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160927	130E113	120VAC/1PH/60HZ	40A	8.6A	36	4	17	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160924	130E110	480VAC/3PH/60HZ	20A	0.65A	16	4	8	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160926	130E112	240VAC/2PH/60HZ	20A	2.23A	16	4	8	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1160928	130E114	120VAC/1PH/60HZ	20A	4.64A	16	4	8	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1166703	130E183	480VAC/3PH/60HZ	10A	0.6A	6	4	2	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1166704	130E184	240VAC/2PH/60HZ	10A	1.13A	6	4	2	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"
1166705	130E185	120VAC/1PH/60HZ	10A	2.15A	6	4	2	Type 12	Yes	15-3/4" X 15-3/4" X 7-7/8"

Combination power supplies split the output current between the MDR supply and the Class 2 supply. The Class 2 supply can use up to 3.7A, in which case the MDR supply would have 36.3A available from a 40A supply.

**MOTOR CONTROL 24VDC POWER SUPPLIES FOR INTELLIROL (USED ONLY WITH MOTORS W/O VFD)**

Item Number	Drawing Number	Input Voltage	Power Supply Size	Input Current	Output Current	Number of MDR	Enclosure Type	UL Listed	Enclosure Dimensions (H x W x D)
1145931	130E043	480VAC/3PH/60HZ	20A	0.65A	20A	9	Type 12	Yes	12"X 12" X 8"
1145930	130E042	480VAC/3PH/60HZ	10A	0.6A	10A	3	Type 12	Yes	12"X 12" X 8"



*IntelliROL Standard Power Supply,  
External View*



*IntelliROL Standard Power Supply, Internal View*

## Chapter 5: FEATURES

### 5.1: ALL INTELLIROL POWER SUPPLIES

#### Lockable Disconnect Switch

All IntelliROL power supplies include a lockable disconnect switch. This allows for lockout/tagout at the power supply.



*IntelliROL Power Supply Lockable Disconnect Switch*

#### Internal Branch Circuit Protection

IntelliROL power supplies are available with internal branch circuit protection. If proper branch circuit protection is not available upstream of the IntelliROL power supply, the power supply should be purchased with branch circuit protection built in.

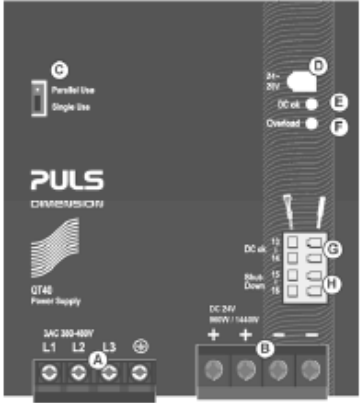
#### Output Current Boost

Each IntelliROL power supply can provide a boost in output current over its nominal rating. The extra current is available for a short period of time. Since IntelliROL conveyor draws maximum current at startup, this current boost is a definite advantage.

## 5.2: POWER SUPPLY FEATURES

Not all power supplies will include these features. This is one of MHS Conveyor power supplies. Smaller units do not have all these features.

Fig. 15-1 Front side



**A Input Terminals** (Screw terminals)  
L1, L2, L3 Line input  
⊕ ...PE (Protective Earth) input

**B Output Terminals** (Screw terminals, two pins per pole)  
+ Positive output  
- Negative (return) output

**C "Parallel Use" "Single Use" Selector**  
Set jumper to "Parallel Use" when power supplies are connected in parallel to increase the output power. In order to achieve a sharing of the load current between the individual power supplies, the "parallel use" regulates the output voltage in such a manner that the voltage at no load is approx. 4% higher than at nominal load. See also chapter 24.7. A missing jumper is equal to a "Single Use" mode.

**D Output Voltage Potentiometer**  
Multi turn potentiometer;  
Open the flap to set the output voltage.  
Factory set: 24.1V at full output current, "Single Use" mode.

**E DC-OK LED** (green)  
On, when the voltage on the output terminals is >90% of the adjusted output voltage

**F Overload LED** (red)  
- On, when the voltage on the output terminals is <90% of the adjusted output voltage, or in case of a short circuit in the output.  
- Flashing, when the shut-down has been activated or the unit has switched off due to over-temperature.  
- Input voltage is required

**G DC-OK Relay Contact**  
The DC-OK relay contact is synchronized with the DC-OK LED.  
See chapter 8 for details.

**H Shut-down and Remote Control Input**  
Allows the power supply to be shut down. Can be activated with a switch contact or an external voltage.  
The remote control input allows adjusting the output voltage. See chapter 9 and 10 for details.

**Indicators, LEDs**

	Overload LED	DC-OK LED	DC-OK Contact
Normal mode	OFF	ON	Closed
During BonusPower®	OFF	ON	Closed
Overload (Vout < 90%)	ON	OFF	Open
Output short circuit	ON	OFF	Open
Temperature Shut-down	flashing	OFF	Open
Active Shut-down input	flashing	OFF	Open
No input power	OFF	OFF	Open

For Puls Power Supply Information visit: <http://www.pulspower.com/us/home/>

## 5.3: DIAGNOSTIC RELAY

The power supply unit inside each IntelliROL power supply has a diagnostic relay that can be used to monitor the status of the unit. When the unit is powered and functioning properly, the diagnostic relay contact will be closed.

### Adjustable Output Voltage

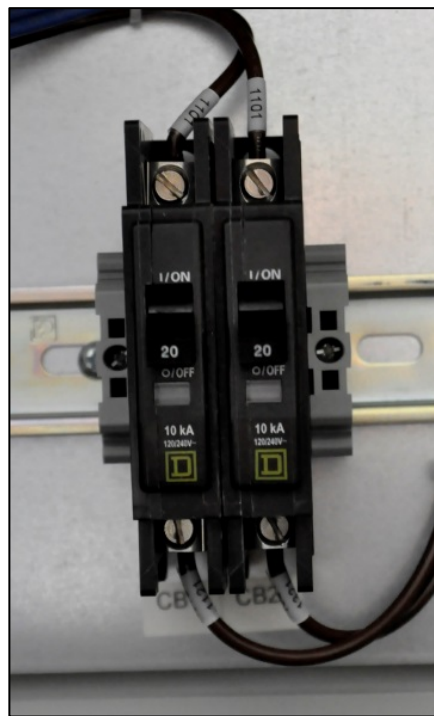
The output voltage of the power supply units is adjustable from 24V to 28.8V. This can be used to possibly overcome a low voltage condition, as long as the maximum voltage at any point in the system does not exceed specifications.

### Status Indicators

Status indicators are provided on the front of the power supply units internal to every IntelliROL power supply. The Uout status indicator will be illuminated green if the output voltage is 21.6V or greater. It will be illuminated red if the output voltage is less than 21.6V and greater than or equal to 7V. If the output voltage is less than 7V, the indicator will not be illuminated at all. There is also an Iout status indicator on the front of the power supply units. It will be illuminated green if the output current is less than or equal to the rated output current. If the output current is greater than the rated output current, the indicator will be illuminated orange. The indicator will be illuminated red if the unit is shut off and in protection mode due to excessive output current.

### Output Circuit Protection

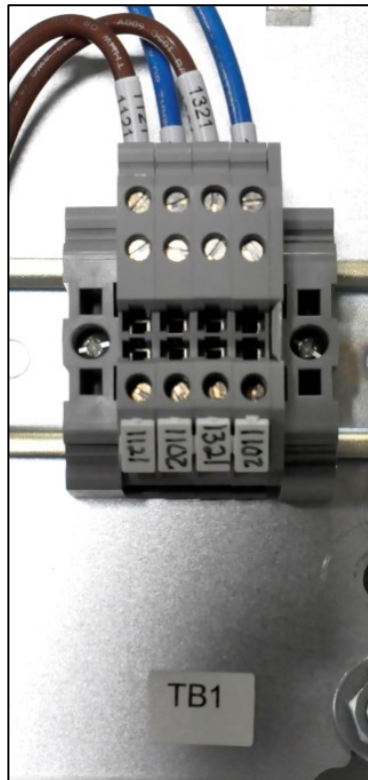
Every IntelliROL power supply includes circuit breaker protection of the output circuits. Power supplies with a 10A output rating have one 10A circuit breaker. Units with a 20A output rating have one 20A circuit breaker. Those with a 40A rating have two 20A circuit breakers, while 80A-rated units have four 20A circuit breakers.



*Output Circuit Protection*

## 5.4: TERMINAL STRIP CONNECTIONS

All output circuit connections are made at a terminal strip. Each IntelliROL power supply has separate terminals for two Class 1 circuits to supply power to the motorized rollers. For the Combination power supplies, there are terminals for one Class 2 circuit to supply power to nearby CRUZcontrol. A power harness is included with each IntelliROL power supply. This can be used to connect the Class 1 circuits of the power supply to the power harness installed on the IntelliROL conveyor.



*IntelliROL Power Supply Terminal Strip*

### Splice Kit

A power splice kit is included with each IntelliROL power supply. The splice kit is used to connect the Class 1 circuits of the power supply to the power harness installed on the IntelliROL conveyor. These are used only in rare cases when a power supply is not installed at the bed joint. Reference the manual drawing inside the kit for installation instructions.

### Common Carrier Power Cable

A common only power cable is included with each IntelliROL power supply. This is used to keep a common connection between separate power supplies.



## Chapter 6: ITR COMBINATION POWER SUPPLIES

---

### Class 2 Output Circuit

IntelliROL Combination power supplies include a 24VDC Class 2 output circuit, in addition to the Class 1 20A circuit(s). For systems with only IntelliROL products, a Standard power supply is all that is needed. However, if a system has a mixture of IntelliROL and CRUZcontrol (NBC or XP43), a Combination power supply can be used to power both the IntelliROL and the CRUZcontrol. A CRUZcontrol tee cable is included with each IntelliROL Combination power supply.

The Class 2 circuit is created by diverting some of the 24VDC power from the main power supply unit to a Class 2 protection module. The protection module can provide up to four Class 2 circuits at 3.7A each. Only one of these circuits is wired to the terminal strip. Keep in mind, each Class 2 circuits can use up to 3.7A from the main power supply unit. This means there is less current available for the motorized rollers.

### Status Indicators

The Class 2 protection module internal to each IntelliROL Combination power supply has status indicators for the input and outputs. The Input Status indicator will be illuminated solid green when the input voltage is above 21V. The input protection circuit will be activated if the input voltage drops to 21V or less. If this occurs, the Input Status indicator will be flashing green. The indicator will be off if there is no input voltage.

There are four Output Failure indicators, one for each Class 2 output circuit, on the Class 2 protection module. The status of the indicators is as follows:

- One is flashing red and the others are on solid red – excessive output current was sensed on the output associated with the flashing indicator.
- All four are flashing red – the output current sum for all four outputs was excessive.
- All four are on solid red and the Input Status indication is flashing green – the input voltage has dropped below 21V and the module is in input protection mode.
- All four are on solid red and the Input Status indication is on solid green – the outputs have been turned off via the ON/OFF button or ON/OFF signal input.
- The indicators associated with outputs 1 and 4, as well as the indicators for outputs 2 and 3 are alternately flashing red – an error internal to the protection module has occurred.

### ON/OFF and Rest Button

The Class 2 protection module has one push button that serves two purposes. If the module is faulted but the fault condition has been resolved, press and hold the ON/OFF – Reset button for more than 1 second to reset the module. If this same button is pressed for more than 50 milliseconds, but less than 1 second, the Class 2 output circuit will switch from on to off or off to on, depending upon their current state.

### I/O Connector

An I/O connector is located on the front of the Class 2 protection module in every IntelliROL Combination power supply. There are three functions controlled via this connector. First, the ON/OFF – Reset function can be controller through terminals 11 and 12 of the connector. It functions in the same manner as the push button. Second, the status of the protection module can be monitored via the Output-OK relay. A set of dry contacts is available through terminals

13 and 14. When the module is operating properly, the contacts will be closed. Third, multiple modules can be synchronized using the Synchronization Bus through terminals 15 and 16. If a module shuts down due to entering input protection mode, all synchronized modules will shut down together.

**A Output Terminals** (plus (+) pole connection points)

**B Red Failure LEDs**  
The red LEDs are failure indicators. Any time a red LED is on or blinking, the outputs have been shutdown.  
Three reasons why the outputs have been shutdown:

- 1) The output current of one or more individual output channels was too high. In this case, the affected output channel LED is blinking and all others are illuminated.
- 2) The sum of the output current of all four output channels was exceeded. In this case, all red LEDs are blinking.
- 3) The outputs needed to be shutdown in order to maintain sufficient input voltage. In this case, all red LEDs are on and the green LED (Input Status) is blinking.

The outputs can also be turned off by pushing the ON/OFF button on the front of the unit or by applying an external signal to the ON/OFF signal input. In this case, all red LEDs are on.

When LED 1 and 4 as well as the LEDs 2 and 3 are alternately blinking, an internal error has occurred. Try to reset the unit by pushing the reset button. If this does not help, ship the unit to the factory for inspection.

**C ON/OFF and Reset Button**  
This is a pushbutton which can be used for two purposes:

- 1) In a failure mode (outputs have shutdown), the outputs can be turned on again by pushing and holding the reset button for more than 1 second.
- 2) In normal mode (outputs have not shutdown), a short (> 50ms) push will turn all outputs ON or OFF.

The unit will be shipped (factory setting) with the outputs turned-on. The ON/OFF function has no safety feature included.

**D Synchronization Bus** (connection by plug-connector on the front). See also chapter 10.  
If multiple PISA modules are used on the same power supply, it is recommended to connect the sync. bus of all modules together. If one unit shuts down due to the protection function of the input voltage protection circuit, all other modules will shutdown too. This avoids a false interpretation of which output channel caused the problem. If the cause for the shutdown was an over-current of one individual channel only this module will shutdown and the other modules will stay on. In this case the sync. line has no impact on the other modules.

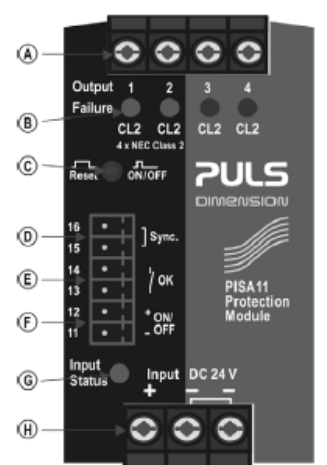
**E Output-OK Relay Contact** (connection by plug-connector on the front). See also chapter 8.  
This relay contact is closed when the input voltage is sufficient and all outputs are not shutdown.

**F Inhibit / Reset Signal Input** (connection by plug-connector on the front). See also chapter 9.  
This signal input is galvanically isolated with an integrated optocoupler and works in the same manner as the reset and ON/OFF button. The ON/OFF function has no safety feature included.

- 1) In a failure mode (outputs have shutdown), the outputs can be turned on again by applying a voltage for more than 1 second.
- 2) In normal mode (outputs have not shutdown), a short (> 50ms) voltage pulse will turn all outputs ON or OFF.

**G Green Input Status LED**  
This LED indicates the status of the input. The green LED is illuminated if the input voltage is higher than 21Vdc. The green LED will blink when the input protection circuit (Safeguard) is activated in order to protect the supply voltage from dropping below 21V or when the outputs have already been shutdown due to a low input voltage.

**H Input Terminals**  
Two minus (-) connection points for simpler load distribution or grounding (earthing) of the minus (-) pole.



The diagram shows the front panel of the PISA 11 Protection Module. It features four output terminals (1-4) at the top, each with a corresponding red failure LED (CL2). Below these is a reset button and an ON/OFF button. A synchronization bus connector is located on the left side, with terminals 11 through 16. An output-OK relay contact is also present. On the right side, there is an input status LED and two input terminals for DC 24V. The module is labeled 'PULS DIMENSION' and 'PISA 11 Protection Module'.

**Please note:**  
Outputs which have shutdown must be turned on manually by pushing the reset button or by an external reset signal (ON/OFF signal input). A cycling of the input power does not reset the unit. The failure signals are stored until a reset is intentionally initiated.

For Puls Power Supply Information visit: <http://www.pulspower.com/us/home/>



# Chapter 7: CONNECTIONS

---

## 7.1: INTERNAL TO POWER SUPPLY

### Incoming Power Circuits

All IntelliROL power supplies have a removable plate on the bottom of the enclosure. This plate can be used as the entry point for cable, conduit, etc. by cutting holes in it for incoming and outgoing power and signals. The incoming power connections are made at the line side of the disconnect switch. There is also a ground lug for connecting the ground wire from the power source. For power supplies that operate on 120VAC, a terminal block is provided for connection of the neutral wire from the source of power.

### Class 1 Circuits (Motorized Roller Power)

The outgoing power connections are made at the terminal strip inside the IntelliROL power supply enclosure. Class 1 Circuit 1 is used to supply power to motorized rollers in an IntelliROL conveyor. The power harness on the conveyor is made up of 10AWG brown and blue wires. The brown wire should be connected to the terminal labeled 1121 on the terminal strip. The blue wire should be connected to the terminal labeled 1102 to the right of the terminal labeled 1121 terminal on the terminal strip. A second Class 1 circuit is available at the terminal strip as well. Class 1 Circuit 2 can also be used to supply power to motorized rollers that are separate from Class 1 Circuit 1. The brown wire of the power harness for the second set of rollers should be connected to the terminal labeled 1321 on the terminal strip. The blue wire should be connected to the terminal labeled 1102 to the right of the terminal labeled 1321 on the terminal strip. The power harness included with every IntelliROL power supply can be used to make these connections. Be sure to follow all applicable codes governing the electrical installation of your IntelliROL conveyor system.

### Class 2 Circuit (CRUZcontrol Power)

The connections for the Class 2 Circuit found in each IntelliROL Combination power supply are made at the terminal strip inside the IntelliROL power supply enclosure. A CRUZcontrol tee cable is used to make the connection between an IntelliROL Combination power supply and a CRUZcontrol system on an XP43 or NBC conveyor system. The tee cable contains four color-coded wires; brown, blue, white and black. The black and white wires are not used when connecting to the power supply. They should be separately insulated against contact with anything else inside the power supply enclosure. The brown wire from the tee cable should be connected to the terminal labeled 1201 on the terminal strip. The blue wire should be connected to the terminal labeled 1102 to the right of the terminal labeled 1201 terminal on the terminal strip.

## 7.2: AT CONVEYOR EQUIPMENT

### **Class 1 Circuits (Motorized Roller Power)**

The power harness included with each IntelliROL power supply has a connector at each end. One connector is female and the other is male. The harness can be cut in the middle and used to connect two Class 1 circuits to the power harnesses of two IntelliROL conveyor systems. This should be done at the joint between two conveyor beds. Instead of connecting the power harnesses from the two beds together, connect them to the two pieces of harness from the power supply via the male and female connectors. The cut ends of the harness pieces should be connected to the power supply terminal strip as described above. Be sure to follow all applicable codes governing the electrical installation of your IntelliROL conveyor system.

### **Class 2 Circuit (CRUZcontrol Power)**

A CRUZcontrol tee cable is used to connect an IntelliROL Combination power supply to a CRUZcontrol system on an XP43 or NBC conveyor system. For an end-fed system, either the male or female connector on the tee cable is connected the compatible connector on the end of the CRUZcontrol interconnection cable. For a center-fed system, both connectors of the tee cable are used to connect to the interconnect cables of two adjacent CRUZcontrol devices. Simply disconnect the two interconnect cables and connect them to the tee cable. For more information, refer to the MHS Conveyor IOM manual for your CRUZcontrol product.

## Chapter 8: APPLICATION

---

### Number of Rollers per Power Supply

The number of motorized rollers used on each Class 1 circuit is a very important aspect of applying an IntelliROL power supply to a conveyor system. The answer depends upon several characteristics of each specific application, such as conveyor speed, product weight, transportation conveyor versus accumulation conveyor, singulated versus slug release, etc. As a general rule of thumb, a 10A circuit can supply power for up to three motorized rollers, while each 20A circuit can power up to nine motorized rollers. This means a power supply rated for 40A output can provide power for up to 18 motorized rollers. A unit rated for 80A can feed up to 36 motorized rollers. Make sure the 36 rollers are evenly distributed amongst the four 20A circuits. No more than nine motorized rollers per 20A circuit. Keep in mind the first 20A circuit in a combination power supply also supplies power for the Class 2 circuit feeding CRUZcontrol. This will reduce the motorized roller count on that first 20A circuit by at least one. The amount of current diverted from the first 20A circuit to the Class 2 circuit depends upon the number of zones of CRUZcontrol being powered by the Class 2 circuit. Please refer to the MHS Conveyor application guidelines for your specific equipment.

## Chapter 9: STATUS INDICATORS

### Standard Power Supplies

The table below lists the expected state of each indicator for all IntelliROL Standard power supplies when they are powered and in normal operation. These indicators can be found on the power supply unit internal to the power supply enclosure. Refer to Table 2: IntelliROL Standard Power Supply Status Indicators.

Indicator	Expected State
Diagnostic Relay	Contact Closed
DC OK	Solid Green

**Table 2: IntelliROL Standard Power Supply Status Indicators**

### Combination Power Supplies

The table below lists the expected state of each indicator for all IntelliROL Combination power supplies when they are powered and in normal operation. These indicators can be found on the Class 2 protection module internal to the power supply enclosure. Refer to Table 3: IntelliROL Combination Power Supply Status Indicators.

Indicator	Expected State
Output-OK Relay	Contact Closed
CL2 Output 1	Off
CL2 Output 2	Off
CL2 Output 3	Off
CL2 Output 4	Off

**Table 3: IntelliROL Combination Power Supply Status Indicators**

# Chapter 10: TROUBLESHOOTING GUIDE

## 10.1: INTELLIROL STANDARD AND COMBINATION POWER SUPPLIES

**Table 4: IntelliROL Standard and Combination Power Supply Troubleshooting Guide**

SYMPTOMS	POSSIBLE CAUSES	RECOMMENDED SOLUTIONS
<b>No output from both Class 1 circuits.</b>	No input power	Make sure power supply is receiving proper input power
	Disconnect switch off	Make sure door is closed and latched. Turn on disconnect switch.
	Input fuse(s) blown (if applicable)	Check for visible signs as to cause of blown fuse(s). If all appears fine, replace fuse(s). If fuse(s) blows immediately, replace power supply unit.
	Output circuit breakers off or tripped	If circuit breakers tripped, resolve cause of tripping. If circuit breakers are off, turn on circuit breakers.
	Power supply unit faulted, DC OK light not illuminated.	After resolving any issues downstream of the power supply unit, turn off disconnect switch and wait for power supply unit to power down. Turn on disconnect switch to re-energize power supply unit. If power supply unit still faulted, turn off output circuit breakers and cycle input power with disconnect switch again. If unit still faulted, replace power supply unit.
<b>No output from one Class 1 circuit</b>	Output circuit breaker tripped or off	If circuit breaker tripped, resolve cause of tripping. If circuit breaker is off, turn on circuit breaker.
<b>Diagnostic Relay open</b>	Issue with power supply unit	Investigate issue with power supply unit

SYMPTOMS	POSSIBLE CAUSES	RECOMMENDED SOLUTIONS
<b>Overload indicator on power supply unit illuminated red</b>	Low output voltage (7V-21.6V)	Look for an issue with a motorized roller or driver card causing it to draw excessive current from the power supply. Consider reducing the number of motorized rollers pulling power from the power supply to reduce the current draw from the power supply unit.
<b>Overload indicator on power supply unit flashing</b>	Shut down activated	Make sure power supply unit is receiving proper input power (disconnect switch is on, fuse(s) are good, if applicable.)
	Unit has switched off due to over temperature	After resolving any issues downstream of the power supply unit, turn off disconnect switch and wait for power supply unit to power down and cool. Turn on disconnect switch to re-energize power supply unit. If power supply unit still faulted, turn off output circuit breakers and cycle input power with disconnect switch again. If unit still faulted, replace power supply unit.

## 10.2: INTELLIROL COMBINATION POWER SUPPLIES

**Table 5: IntelliROL Combination Power Supply Troubleshooting Guide**

SYMPTOMS	POSSIBLE CAUSES	RECOMMENDED SOLUTIONS
<b>No output from Class 2 circuit</b>	Output turned off at Class 2 protection module (all four Output Failure indicators are illuminated red and Input Status indicator is illuminated green)	Press ON/OFF-Reset push button on Class 2 protection module for less than 1 second to turn on Class 2 outputs. Alternatively, apply a 24VDC signal to the ON/OFF-Reset input on terminals 11 and 12 of the Class 2 protection module for less than one second.
	Input protection circuit activated due to low-voltage input at Class 2 protection module (all four Output Failure indicators are illuminated red and Input Status indicator is flashing green)	Input voltage to Class 2 protection module has dropped below 21V. Resolve low-voltage issue with main power supply unit. Once issue has been resolved, press ON/OFF-Reset push button on Class 2 protection module for more than 1 second to reset input protection circuit. Alternatively, apply a 24VDC signal to the ON/OFF-Reset input on terminals 11 and 12 of the Class 2 protection module for more than one second.
	Output circuit faulted	Investigate issue with Class 2 protection module (Output Failure and Input Status indicators.)
<b>Output-OK Relay open at terminals 13 and 14 on Class 2 protection module</b>	Issue with Class 2 protection module	Investigate issue with Class 2 protection module (Output Failure and Input Status indicators.)

SYMPTOMS	POSSIBLE CAUSES	RECOMMENDED SOLUTIONS
<b>Input Status indicator not illuminated on Class 2 protection module</b>	No input voltage at Class 2 protection module	Investigate issue with no voltage from main power supply unit output to input on Class 2 protection module.
<b>Input Status indicator flashing green on Class 2 protection module</b>	Input protection circuit activated due to low-voltage input at Class 2 protection module (all four Output Failure indicators are illuminated red)	Input voltage to Class 2 protection module has dropped below 21V. Resolve low-voltage issue with main power supply unit. Once issue has been resolved, press ON/OFF-Reset push button on Class 2 protection module for more than 1 second to reset input protection circuit. Alternatively, apply a 24VDC signal to the ON/OFF-Reset input on terminals 11 and 12 of the Class 2 protection module for more than one second.
<b>Class 2 protection module Output Failure indicators; 1 flashing red, 3 illuminated red</b>	Class 2 output associated with flashing indicator shutdown due to the Class 2 output exceeding rated output current	<p>Look for an issue with a CRUZcontrol component causing it to draw excessive current from the Class 2 circuit.</p> <p>Consider reducing the number of CRUZcontrol components pulling power from the Class 2 circuit to reduce the current draw.</p>
<b>Class 2 protection module Output Failure indicators; 4 flashing red</b>	All Class 2 outputs shutdown due to the sum of all Class 2 outputs exceeded rated output current	<p>This only applies when using all four Class 2 circuits. Look for faulty components on the Class 2 circuits causing excessive current draw.</p> <p>Consider reducing the number of devices pulling power from the Class 2 circuits to reduce the current draw.</p>



SYMPTOMS	POSSIBLE CAUSES	RECOMMENDED SOLUTIONS
<b>Class 2 protection module Output Failure indicators; 4 illuminated red</b>	Input protection circuit activated due to low-voltage input at Class 2 protection module (Input Status indicator flashing green)	Input voltage to Class 2 protection module has dropped below 21V. Resolve low-voltage issue with main power supply unit. Once issue has been resolved, press ON/OFF-Reset push button on Class 2 protection module for more than 1 second to reset input protection circuit. Alternatively, apply a 24VDC signal to the ON/OFF-Reset input on terminals 11 and 12 of the Class 2 protection module for more than one second.
<b>Class 2 protection module Output Failure indicators; 4 illuminated red</b>	Output turned off at Class 2 protection module (Input Status Indicator illuminated green)	Press ON/OFF-Reset push button on Class 2 protection module for less than 1 second to turn on Class 2 outputs. Alternatively, apply a 24VDC signal to the ON/OFF-Reset input on terminals 11 and 12 of the Class 2 protection module for less than one second.
<b>Class 2 protection module Output Failure indicators; 1 and 4, as well as 2 and 3, alternately flashing red</b>	Internal error in Class 2 protection module	Press ON/OFF-Reset push button on Class 2 protection module for more than 1 second to reset input protection circuit. Alternatively, apply a 24VDC signal to the ON/OFF-Reset input on terminals 11 and 12 of the Class 2 protection module for more than one second. If Class 2 protection module cannot be reset, replace it with a new module.

# Chapter 11: SPECIFICATIONS

## 11.1: ITR STANDARD AND COMBINATION (480VAC INPUT)

**Table 6: IntelliROL Standard and Combination Power Supplies (480VAC Input)**

ATTRIBUTE		DESCRIPTION			
<b>Part Numbers</b>	1166694, 1166697, 1166700, 1166703	1160915, 1159647, 1160918, 1160924	1160913, 1159645, 1160917, 1160923	1176603, 1176628	
<b>Input Voltage</b>	380-480V	380-480V	380-480V	380-480V	
	3PH or 2PH	3PH	3PH	3PH	
	60Hz	60Hz	60Hz	60Hz	
<b>Input Current</b>	0.6A	0.65A	1.4A	2.8A	
<b>Input Fusing (if applicable)</b>	4A	2A	4A	6A	
<b>Output Voltage</b>	24VDC	24VDC	24VDC	24VDC	
<b>Rated Output Power</b>	240W	480W	960W	1920W	
<b>Rated Output Current</b>	10A	20A	40A	80A	
<b>Input Voltage Range</b>	380-480VAC	380-480VAC	380-480VAC	380-480VAC	
<b>Inrush Current</b>	<= 30A	<= 25A	<= 25A	<= 8A	
<b>Output Voltage Range</b>	24-28.8VDC	24-28.8VDC	24-28.8VDC	Factory set to 24.1VDC	
<b>Relative Humidity (Operating)</b>	0-90% No condensation	0-90% No condensation	0-90% No condensation	5-95% No condensation	
<b>Ambient Temperature (Operating)</b>	0-50°C for 100% output current, up to 60°C for 80% output current	0-50°C for 100% output current, up to 60°C for 80% output current	0-50°C for 100% output current, up to 60°C for 80% output current	-25-60°C for 100% output current, up to 70°C for 75% output current	
<b>Enclosure Type</b>	Type 12	Type 12	Type 12	Type 12	
<b>Enclosure Dimensions</b>	400mm H	400mm H	400mm H	400mm H	
	400mm W	400mm W	400mm W	400mm W	
	200mm D	200mm D	200mm D	200mm D	

## 11.2: ITR STANDARD AND COMBINATION (208/240VAC INPUT)

ATTRIBUTE		DESCRIPTION	
Part Numbers	1166695, 1166698, 1166701, 1166704	1160949, 1160954, 1160920, 1160926	1160948, 1160953, 1160919, 1160925
Input Voltage	100-240V/1PH/60Hz	100-240V/1PH/60Hz	100-240V/1PH/60Hz
Input Current	1.13A	2.23A	4.5A
Input Fusing (if applicable)	4A	6A	12A
Output Voltage	24VDC	24VDC	24VDC
Rated Output Power	240W	480W	960W
Rated Output Current	10A	20A	40A
Input Voltage Range	100-240VAC	100-240VAC	100-240VAC
Inrush Current	<= 30A	<= 30A	<= 60A
Output Voltage Range	24-28.8VDC	24-28.8VDC	24-28.8VDC
Relative Humidity (Operating)	0-90%	0-90%	0-90%
Ambient Temperature (Operating)	0-50°C for 100% output current, 0-60°C for 80% output current	0-50°C for 100% output current, 0-60°C for 80% output current	0-50°C for 100% output current, 0-60°C for 80% output current
Enclosure Type	Type 12	Type 12	Type 12
Enclosure Dimensions	400mm H	400mm H	400mm H
	400mm W	400mm W	400mm W
	200mm D	200mm D	200mm D

## 11.3: ITR STANDARD AND COMBINATION (120VAC INPUT)

ATTRIBUTE		DESCRIPTION	
Part Numbers	1166696, 1166699, 1166702, 1166705	1160951, 1160956, 1160922, 1160928	1160950, 1160955, 1160921, 1160927
Input Voltage	100-240V/1PH/60Hz	100-240V/1PH/60Hz	100-240V/1PH/60Hz
Input Current	2.15A	4.64A	8.6A
Input Fusing (if applicable)	6A	10A	20A
Output Voltage	24VDC	24VDC	24VDC
Rated Output Power	240W	480W	960W
Rated Output Current	10A	20A	40A
Input Voltage Range	100-240VAC	100-240VAC	100-240VAC
Inrush Current	<= 30A	<= 30A	<= 60A
Output Voltage Range	24-28.8VDC	24-28.8VDC	24-28.8VDC
Relative Humidity (Operating)	0-90%	0-90%	0-90%
Ambient Temperature (Operating)	0-50°C for 100% output current, 0-60°C for 80% output current	0-50°C for 100% output current, 0-60°C for 80% output current	0-50°C for 100% output current, 0-60°C for 80% output current
Enclosure Type	Type 12	Type 12	Type 12
Enclosure Dimensions	400mm H	400mm H	400mm H
	400mm W	400mm W	400mm W
	200mm D	200mm D	200mm D

## 11.4: CLASS 2 PROTECTION MODULE

ATTRIBUTE	DESCRIPTION
<b>Part Numbers</b>	1160917, 1160918, 1160919, 1160920, 1160921, 1160922, 1160923, 1160924, 1160925, 1160926, 1160927, 1160928, 1166700, 1166701, 1166702, 1166703, 1166704, 1166705
<b>Nominal Input Voltage</b>	24VDC
<b>Number of Class 2 Circuits</b>	4 (1 connected to terminal strip)
<b>Rated Output Current</b>	4 x 3.7A at 24V 4 x 3.2A at 28V
<b>Ambient Temperature (Operating)</b>	-25°C to 70°C
<b>Output Current Shutdown Limit</b>	19.9A typical for sum of all four circuits
<b>Output Current Shutdown Range</b>	16.6-23.6A for sum of all four circuits
<b>Minimum Input Voltage for Output-OK Relay to Close</b>	21.4V typical
<b>Output-OK Relay Contact Ratings</b>	30VDC, 1A maximum; 30VAC, 0.5A maximum; 5VDC, 1mA minimum
<b>ON/OFF-Reset Input Ratings</b>	6-10VDC minimum, 30VDC maximum; 3mA typical, 6mA maximum
<b>Approvals</b>	UL508 Listed for use in Industrial Control Equipment
	NEC Class 2 according to Article 725-41 (4)
	UL 60950-1 Listed as Limited Power Source (LPS)

## 11.5: CRUZCONTROL TECHNICAL DATA

### CRUZcontrol Power Supply Specification

Technical Data	PN 1117431	PN 1117432
<b>Input Parameters</b>		
Input Voltage Range V AC (nominal)	100... 120/220...240 V	380...480 V (2 phase)
Input Voltage Range V AC (continuous)	85... 132/1184...264 V	323...552 V (2 phase)
Input Frequency	47...63 Hz	47... 63 Hz
Phase	1	2
Input Voltage Range V DC (see derating requirements)	220...375 V	consult factory
Input Rated Current	< 2.0 A (100 V AC)	< 0.42 A (400 V AC)
	< 0.95 A (196 V AC)	< 0.36 A (480 V AC)
Transient Immunity Over Entire Load Range		Consult factory
<b>Output Parameters</b>		
Output Voltage	24...28 V DC	24... 28 V DC
Output Voltage Preset	24.5 V DC ±0.5%	24.5 V DC ± 0.5%
Ripple/Noise @ 20 MHz, 50 Ohm	< 50 m Vpp	< 50 m Vpp
Output Voltage Regulation Accuracy	0.5% Vout static	± 200 mV static
	±1.5% Vout dynamic	Dynamic not available
Output Rated Current	3.9 A (at 24 V)	3.75 A (at 24 V)
	3.2 A (at 28 V)	3.2 A (at 28 V)
Hold Up Time	> 20 ms (196 V AC, 24.5V/3.9 A)	Typ. 52 ms (at 400 V)
	> 20 ms (100 V AC, 24.5 V/3.9A)	Typ. 93 ms (at 480 V)
<b>General Device Parameters</b>		
Operating Temperature Range (Tamb) - Full Load	14... 140°F (-10...60 C)	14... 140°F (-10...60 C)
Operating Temperature Range (Tamb) - Derated	122... 140°F (50...60 C)	122... 140°F (50...60 C)
Storage Temperature	-13...185°F (-25...85 C)	-13...185°F (-25...85 C)
Humidity (Do not energize when condensation is present)	< 93%	< 95%
Input Cable Access	3/4 or 1/2 in. hole for conduit	
AC Connection Wires		
Stranded cable	0.3...2.5 mm2 / AWG 28-12	≥ 2,5 mm2 , AWG 26-12
Solid cable	0.3...4 mm2 / AWG 28-12	≥ 2,5 mm2 , AWG 26-12
Stripping at wire end	6 mm	6 mm
<i>Note: secure wires from strain</i>		
AC External Protection/Fusing	20A Max	30A Max
Output Connector Cables	M12 4-pin "T" cable	M12 4-pin "T" cable
Efficiency	90% (typical at 230 V AC, 3.9A)	89.5% (at 400 V)
		89.0% (at 480 V)
Protection Class - Type 1 Enclosure	IP 20 (DIN/IEC 60 529)	IP 20 (DIN/IEC 60 529)
MTBF	500,000 h @ 40C SN 29500	1.5 Mio h @ 40C SN 29500
	Not tested at MIL 217 GP40	482,000 h @ MIL 217 GP40
Dimensions	9.25 x 5.67 x 5.13	9.25 x 5.67 x 5.13
	(235 x 144 x 130.4 mm)	(235 x 144 x 130.4 mm)
Weight	3.9 lbs (1.8 kg)	4.4 lbs (2.0 kg)
Cover Screw Torque Rating (in-lb)	4±1	4±1
Mounting	Vertical mounting only. AC input enters from the bottom	
Clearance	Keep 4 in. clearance from ventilating slots in cover	
<b>Applicable Standards</b>		
EN 60 950-1, IEC 60 950	Yes	Yes
EN 60 204-1, EN 50 178	Yes	Yes
<b>Third Party Approvals</b>		
UL 508 Listing (US and Canada)	Multiple Listing	Multiple Listing
UL 60 950-1 Recognition (US and Canada)	Multiple Listing	Multiple Listing
NEC Class 2 According to UL 1310	Multiple Listing	Multiple Listing

## WORKS CITED

---

- AISC. (2015). *American Institute of Steel Construction*. Retrieved 1 14, 2015, from <https://www.aisc.org/>
- ANSI. (2013-2014). *American National Standards Institute*. Retrieved 2014, from ANSI Standards Store: <http://www.ansi.org/>
- OSHA. (2014). *Occupational Safety & Health Administration*. Retrieved 2014, from OSHA QuickTakes: <https://www.osha.gov/>
- Puls. (2018). *PULS (USA)*. Retrieved from PULS: <http://www.pulspower.com/us/home/>
- SICK. (2019). *Sick Sensor Intelligence*. Retrieved from <https://www.sick.com/us/en/>

## MHS GENERAL INFORMATION

**MHS Website Link:**

[mhs-conveyor.com](http://mhs-conveyor.com)

## MHS Conveyor INFORMATION

---

### Mission

MHS Conveyor, located in Spring Lake, Michigan, is a leading deliverer of “smart” material handling systems, technologies, products, and services, creating solutions for material flow applications. As a global supplier of conveyor systems and equipment since 1964, MHS Conveyor provides sorters, conveyors, and accessories to satisfy a broad spectrum of accumulation, transportation, and sortation applications.



MHS Conveyor Inc.  
1300 Mt. Garfield  
Norton Shores, MI 49441 USA

231.798.4547

Email: [us-info@mhs-conveyor.com](mailto:us-info@mhs-conveyor.com)

Web Site : [mhs-conveyor.com](http://mhs-conveyor.com)



Regional sales offices and authorized Business Partners located throughout the United States and Canada. Licensees and Business Partners in Europe, South America, and Southeast Asia.