Guardian 2.0



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GUARDIAN 2.0 CONTINUOUS MONITORING SYSTEM

PL3309 REV. A
IAW ECN-5581

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The Productivity Devices Company

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Safety

Read and follow the safety guidelines in the Vektek Inch Hydraulic Catalog before proceeding. Be sure **TO *ALWAYS* DISCONNECT POWER AND DISCHARGE HYDRAULIC PRESSURE** before **ANY** service work is done. Be sure to practice **LOCKOUT-TAGOUT** procedures on power sources both electronic and hydraulic.

Vektek, LLC reserves the right to change specifications without notice as a part of our ongoing product improvement process

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Planning

Why Wireless Pressure Monitoring?

In the realm of modern manufacturing, particularly within hydraulic workholding systems, wireless pressure monitoring has emerged as a pivotal technology. The Vektek Guardian 2.0™ wireless pressure monitoring systems exemplify this innovation. These systems ensure precise clamping force, detect circuit failures, and enhance the consistency, safety, and efficiency of the manufacturing process.

What are the Advantages of Wireless Pressure Monitoring?

- Ensures Consistent Quality: Proper pressure ensures that fixtures hold parts securely and accurately, leading to consistent and high-quality production.
- Prevents Equipment Damage: Monitoring pressure helps in detecting circuit failures early, preventing potential damage to spindles, tooling, fixtures and the parts being machined.
- Enhances Safety: Maintaining the correct pressure is essential for safe operations.
- Optimizes Efficiency: By ensuring that fixtures are operating at required pressure, you can improve the overall efficiency of the manufacturing process. This can lead to reduced tooling damage and lower operational costs.
- Maintains Clamping Force: Hydraulic workholding relies on proper clamping force to hold workpieces securely. Monitoring pressure ensures that the clamping force remains consistent, preventing workpieces from shifting or slipping during machining that can cause defects such as chatter.
- Prevents Fixturing System Failures: Continuous pressure monitoring can detect leaks or pressure drops early, allowing for corrective actions to prevent fixturing system failures that could halt production resulting in downtime and missed deadlines.

Guardian 2.0 Operation Goals Checklist *(what to know before you start)*

- ☐ What do you want to happen if low pressure is detected?
- ☐ Where are the User I/O terminals located?
- ☐ Will you use custom I/O for In-Cycle and Main Contact (pressure good) Or utilize alternate signals such as Feed-Hold or E-Stop terminals on my machine tool.
- ☐ Is your machine positive or negative case ground (which is switched on/off)?
- ☐ Where do you want to locate the Guardian 2.0 Master Control Unit?
- ☐ Where will you get power for the Master Control Unit? (24VDC)
- ☐ Where will you locate the Guardian 2.0 Fixture Transmitters on your pallet?
- ☐ Does your fixture have multiple hydraulic circuits that need monitored?
- ☐ What is the critical pressure at which you want the machine to stop?
- ☐ Will you need help from the Machine Tool Distributor's service staff or does your staff have the knowledge and ability to install the Guardian 2.0?
- ☐ If you are using the optional Pallet ID Reader system, where do you want to locate the reader inside or outside the machine enclosure? (6 feet read distance to Pallet ID Tag)
- ☐ What length of cables are going to be necessary to mount the Pallet ID Reader to the Master Control Unit, ≤ 32.8 feet?

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System Components Summary

The Guardian 2.0™ is a wireless pressure monitoring system designed to communicate pressure feedback from hydraulic workholding fixtures to a CNC machine controller. The Guardian 2.0™ System consists of a minimum of two devices, the MASTER CONTROL UNIT(MCU) and the FIXTURE TRANSMITTER UNIT(FTU). Optionally a Pallet ID Reader can be used with the system for wireless identification of the fixture when it comes into the work area.

The FIXTURE TRANSMITTER UNIT is a sealed (IP67 rated), compact, low power device that requires (2) Lithium CR2 batteries. The FIXTURE TRANSMITTER UNIT accepts an input from a non-powered/dry contact sensing switch via an M8 IP67 shielded cable and continuously reports the status of this pressure switch over a radio link to the Master Control Unit. Vektek recommends pressure switch, P/N 70-7500-78, for hydraulic pressure monitoring. One Fixture Transmitter Unit per pallet. If you are using a multi-sided/hydraulic circuit fixture, 2 -3 or 4 pressure switches can report to a single Fixture Transmitter Unit.

The MASTER CONTROL UNIT (IP65 rated) features an LCD display to communicate with a human operator as well as a digital interface allowing the device to communicate with an external machine controller or PLC (Programmable Logic Control). The MASTER CONTROL UNIT is the hub of the Guardian 2.0 System. The Guardian 2.0 system allows your pressure switch on the fixture to wirelessly communicate with your machine tool through the MASTER CONTROL UNIT. The master Control Unit can communicate with many different fixtures. Selection of the fixture that the Master Control Unit is communicating to in the work area is determined two different ways. The first way is through selection of the "Pallet Number" through a discrete digital input via the M12-8 connector and the CNC Machine control system can communicate up to 64 different pallet numbers. The other method is through the use of the optional Pallet ID Reader system, where wireless interrogation of the unique pallet ID of the pallet currently in the work area. Using the Pallet ID Reader allows the management of over 200 pallets.

The Pallet ID Reader is an optional component that can wirelessly read a unique Pallet ID tag placed on each fixture pallet and communicate to the Master Control Unit. The Pallet ID Reader connects to the MASTER CONTROL UNIT via an M12 cable. The M12 IP67 shielded cable carries information from the Pallet ID Reader to the MASTER CONTROL UNIT. The Pallet ID Reader reads the Pallet ID Tag wirelessly. The Pallet ID Reader is a fully sealed unit (IP67 rated) that will mount within the machine enclosure or work area.

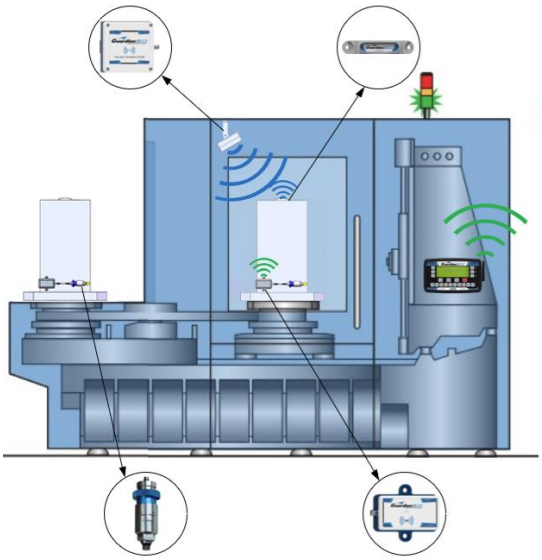


Figure 1:SYSTEM USING PALLET ID READER

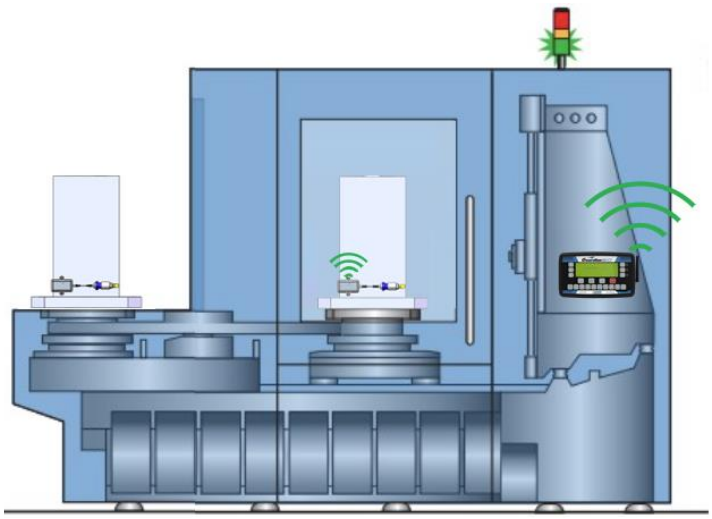
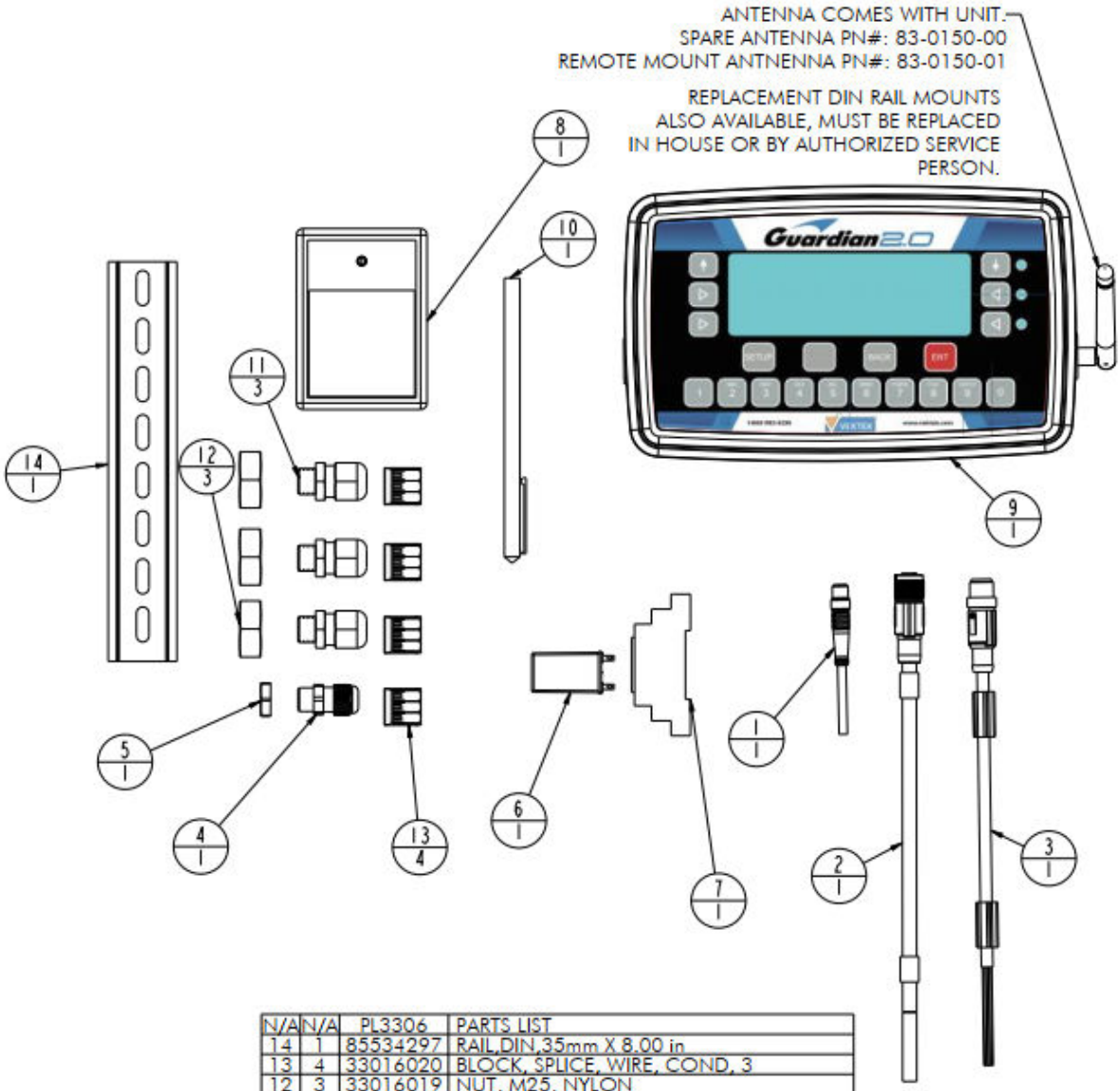


Figure 2: SYSTEM USING BINARY INPUT PALLET ID

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System Diagrams

33-0112-10 *THE MASTER CONTROL UNIT KIT*

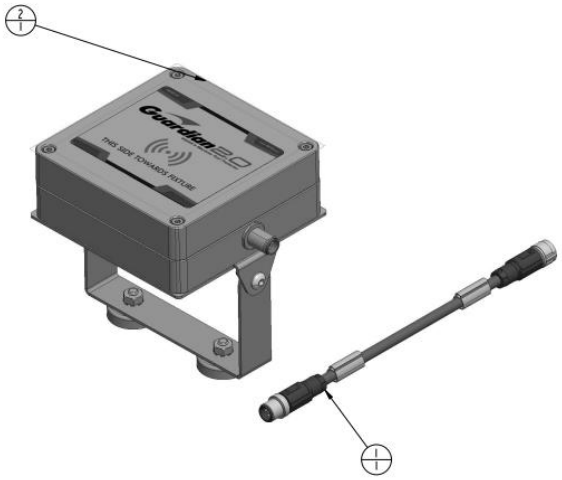


N/A	N/A	PL3306	PARTS LIST
14	1	85534297	RAIL,DIN,35mm X 8.00 in
13	4	33016020	BLOCK, SPLICE, WIRE, COND, 3
12	3	33016019	NUT, M25, NYLON
11	3	33016018	RELEIF, STRAIN, CORD, M25
10	1	33015043	PEN, MAGNET
9	1	33012001	MCU, GUARDIAN 2.0
8	1	33011015	ASSY,PPMS,CHECKER,SETTER,SWITCH
7	1	29411108	SOCKET, RELAY, DPDT
6	1	29411107	RELAY, DPDT, 24VDC, 5AMP
5	1	28645003	NUT,LOCK,NYLON,M12
4	1	28512405	RELIEF,STRAIN,CORD,M12
3	1	27742406	CABLE, 8 PIN, M12, 5m
2	1	27742405	CABLE, 12 PIN, M12, 5m
1	1	27542400	27542400 M8 MALE END
No.	QTY	PART No.	DESCRIPTION

Figure 3: MCU KIT BREAKDOWN

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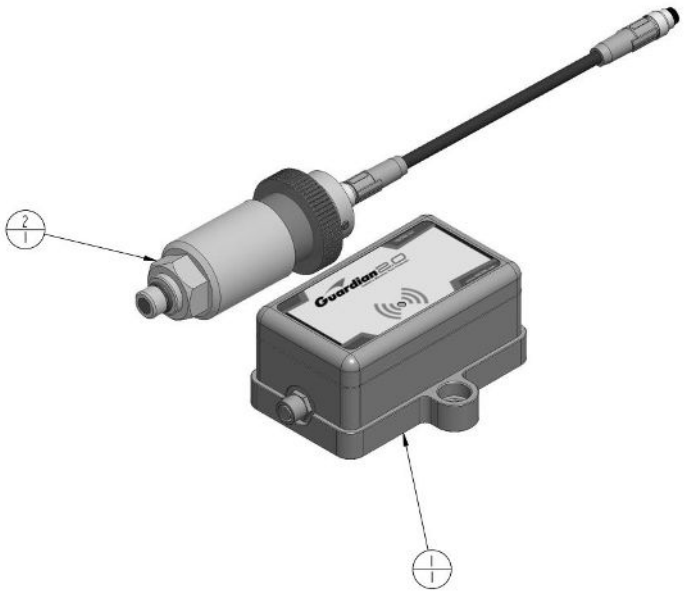
33-0112-20 *THE PALLET ID READER KIT*



N/A	N/A	PL3308	PARTS LIST
2	1	33012040	ASSY, READER, ID, PALLET, GUARDIAN 2.0, W/BRACKET
1	1	27942201	CABLE,SHLD,M12 MALE,M12 FEM,5PIN,10M
No.	**QTY**	**PART No.**	**DESCRIPTION**

Figure 4: PALLET ID READER KIT BREAKDOWN

33-0112-21 *THE SINGLE FIXTURE TRANSMITTER KIT*

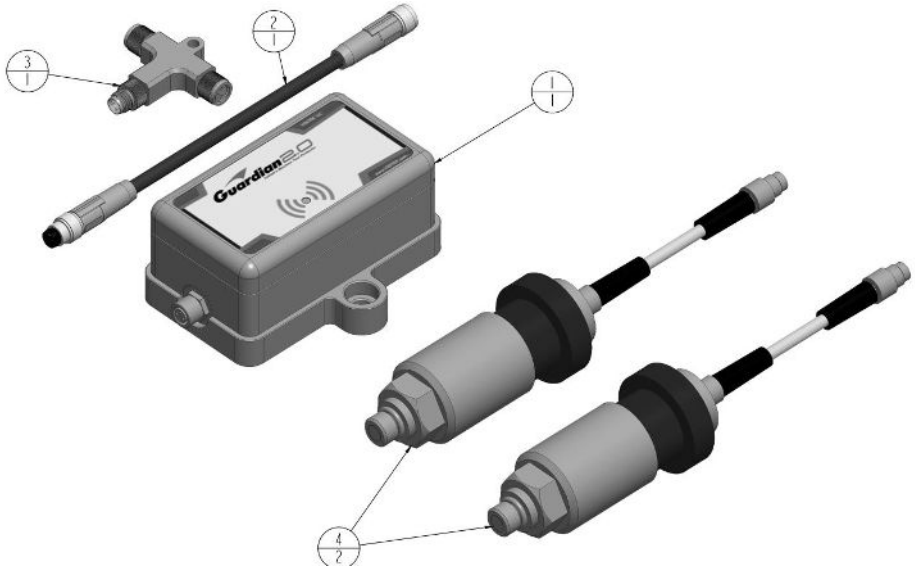


N/A	N/A	PL3307	PARTS LIST
2	1	70750078	ASSY,SWITCH,PRESS,0.5M CABLE
1	1	33012030	ASSY, TRANSMITTER, RF, GUARDIAN
No.	**QTY**	**PART No.**	**DESCRIPTION**

Figure 5: SINGLE FTU KIT BREAKDOWN

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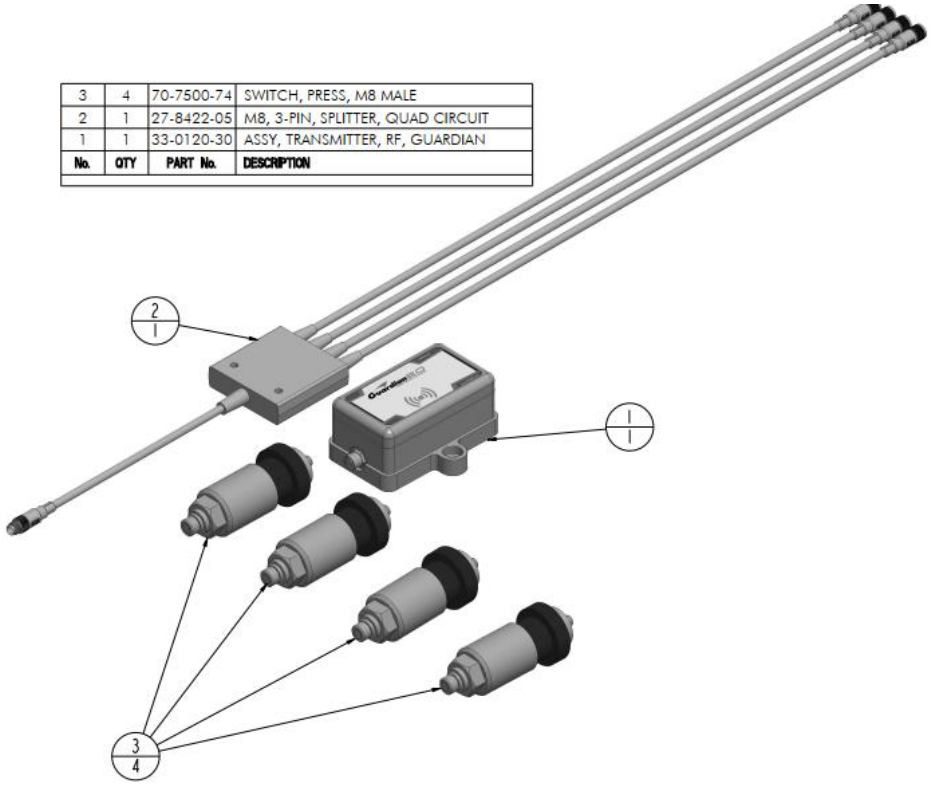
33-0112-22 *THE DUAL FIXTURE TRANSMITTER KIT*



No.	QTY	PART No.	DESCRIPTION
4	2	70-7500-78	SWITCH, PRESSURE, 0.5M CABLE
3	1	27-8422-04	M8, 3-PIN, SPLITTER, DUAL CIRCUIT
2	1	27-7424-01	CORDSET,MALE,FEMALE,M8, .6M,SHIELDED
1	1	33-0120-30	ASSY, TRANSMITTER, RF, GUARDIAN

Figure 6: DUAL FTU KIT BREAKDOWN

33-0112-23 *THE QUAD FIXTURE TRANSMITTER KIT*



No.	QTY	PART No.	DESCRIPTION
3	4	70-7500-74	SWITCH, PRESS, M8 MALE
2	1	27-8422-05	M8, 3-PIN, SPLITTER, QUAD CIRCUIT
1	1	33-0120-30	ASSY, TRANSMITTER, RF, GUARDIAN

Figure 7: QUAD FTU KIT BREAKDOWN

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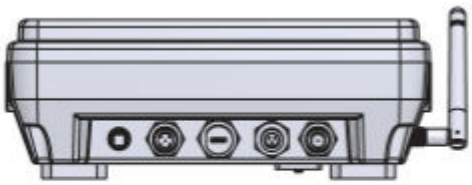
Components and Features:

THE MASTER CONTROL UNIT (MCU)

The Master Control Unit is the heart of the Guardian 2.0 System. It forms the Communication bridge between Guardian 2.0 equipped fixtures and the CNC Machine Controller. It can report the pressure status of over 200 fixture transmitters and will verify fixture identification prior to the machining process. During the machining operation it will continuously report the pressure status of the selected fixture and alarm at user defined pressure presets.



Figure 8: MCU FUNCTIONS



Port	Application
M12 12-PIN	Main System Connection
M12 8-PIN	Pallet ID Input
USB-C	Firmware Update Port
M12 5-PIN	Pallet ID Reader
M8 3-PIN	Pallet Selected RS-232

Figure 9: MCU ELECTRICAL PORTS OVERVIEW

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THE FIXTURE TRANSMITTER UNIT (FTU)

The new and improved Guardian 2.0 Fixture Transmitter Unit wirelessly communicates with the Master Control Unit using 900mhz frequency band powered by long life, easily replaceable batteries with low battery indication at Master Control Unit screen.



Figure 10: FIXTURE TRANSMITTER UNIT

THE PALLET ID READER

The Pallet ID Reader is optional with the Guardian 2.0 System. When used it reads the Pallet ID Tag to confirm fixture identification prior to machining process. It then sends this information to the Master Control Unit to tell it what pallet is in the work area. Using the Pallet ID Reader and corresponding Pallet ID tags allows for a simpler install than the other pallet ID method which is described below in the "QUICK START GUIDE" section.



Figure 11: PALLET ID READER

PALLET ID TAGS

Used in conjunction with the Pallet ID Reader, the optional Pallet ID Tag acts as a unique identifier for the pallet in the work area being monitored. These tags should be installed on the pallet or fixture within 6 feet of the Pallet ID Reader. It is important to note that they should be within an unobstructed view of the Pallet ID Reader and that they can be mounted directly to metal surfaces without any signal interference. When being used the Pallet ID Reader will read the Pallet ID Tag and tell the MCU using RF technology which pallet is in the work area.

Below are the two types of Pallet ID Tag. Figure 12 shows the "Standard" Pallet ID Tag used in conjunction with an FTU on pallets with pressure monitored circuits. Figure 13 shows the Manual Pallet ID Tag, which is used on pallets that do not have or need pressure monitoring. This manual tag allows the MCU to still recognize these fixtures and reports back a false "Pressure Good" signal in lieu of an FTU.



Figure 12: STANDARD PALLET ID TAG



Figure 13: MANUAL PALLET ID TAG

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Installation:

Installing the FIXTURE TRANSMITTER UNIT

Note: Shielding is not necessary or allowed. The transmitter is IP 67 rated, and any metal shielding will interfere with communication.

Step 1: Install the two included CR 2 batteries into the Fixture Transmitter Unit. Reference Figure 72 for more information.

Step 2: Mount the transmitter using 2 ea ¼" or 6mm bolts oriented so the M8 connector is readily accessible to connect the switch cable. When mounting give consideration to where the cable will be routed insuring it will not have a bend radius tighter than 6" and that it will not be in the way of machine movements or operations. Below are mounting dimensions for the Fixture Transmitter and optional dual or quad splitters.

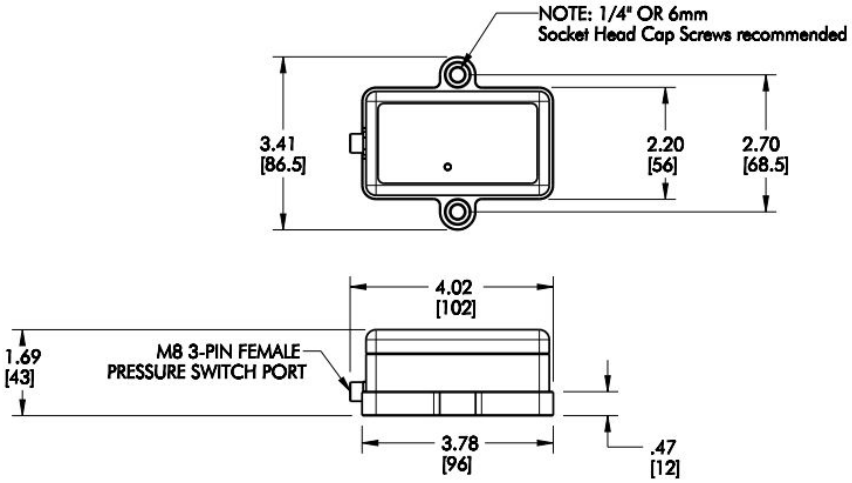


Figure 14: Fixture Transmitter 33-0120-30 mounting dimensions

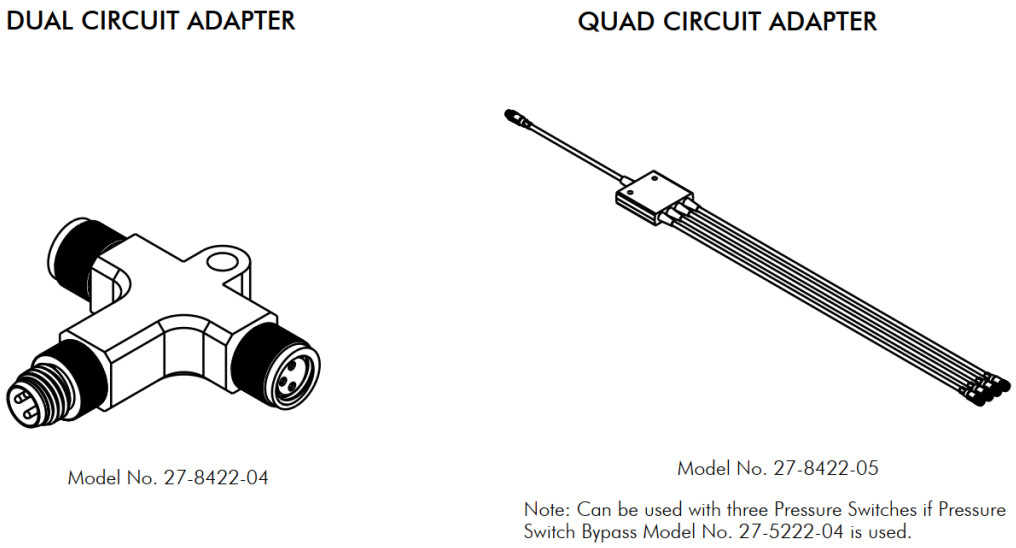


Figure 15: THE FAMILY OF SPLITTERS

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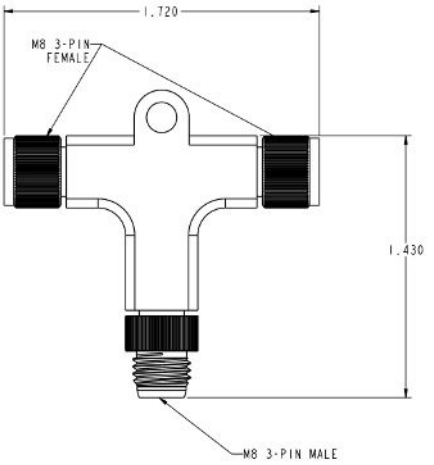


Figure 16: DUAL SPLITTER MOUNTING DIMENSIONS

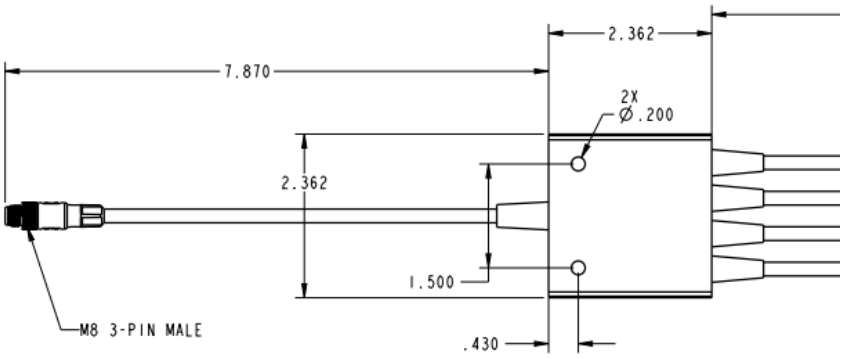
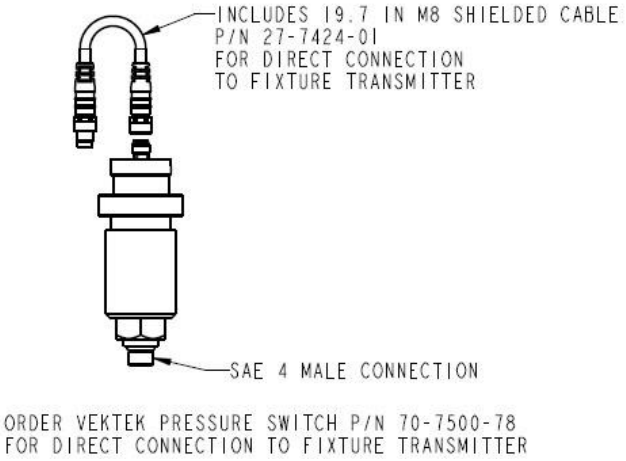


Figure 17: QUAD SPLITTER MOUNTING DIMENSIONS

GUARDIAN FIXTURE TRANSMITTER ACCESSORIES	
70-7500-78	750-5000PSI PRESSURE SWITCH WITH 19.7 IN CABLE (SHOWN)
70-7500-74*	750-5000PSI PRESSURE SWITCH WITH M8 MALE CONNECTION ONLY
27-7424-01	M8 SHIELDED PATCH CABLE (MALE TO FEMALE) FOR USER PROVIDED NON-POWERED SWITCH OR REPLACEMENT FOR 70-7500-78

*70-7500-74- REQUIRES USER PROVIDED 3 PIN M8 SHIELDED CABLE



ORDER VEKTEK PRESSURE SWITCH P/N 70-7500-78
FOR DIRECT CONNECTION TO FIXTURE TRANSMITTER

Figure 18: PRESSURE SWITCH OPTIONS

Step 3: Connect the Pressure Switch to the intended circuit you wish to monitor.

Step 4: Connect the switch cable to the transmitter.

Step 5: Set pressure switch using the instructions in the next section.

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Setting the pressure switch

The purpose of the Pressure Switch Setter/Checker is to assist the user of Vektek Mechanical Pressure Switches in the setting of the pressure switch point and operation of the switch. It allows instant feedback of the pressure switches NO contacts and if it opens or closes at a specific set point.



Figure 19: THE PRESSURE SETTER CHECKER

1. Make sure you have good batteries in the Pressure Switch Setter/Checker. (Depending on the model it will be 2-AAA or 1-9V batteries.)
2. Connect the attached cable to the Vektek Mechanical Pressure switch connector.
3. Apply the amount of hydraulic pressure you want the pressure switch to activate at. We recommend 250-400 psi below your fixture/pump operational pressure. The exact pressure will need to be determined by the fixture designer. You want the pressure switch to open its contacts before enough pressure is lost to damage a part, let it shift or come out. If the pressure is set to close to the full operational pressure of the fixture, then there could be false alarms caused by normal pressure fluctuations in the system.
4. Turn the adjustment ring of the pressure switch until the LED light is NOT illuminated. (clockwise)
5. Then turn the pressure setting ring back up (counterclockwise) until the LED light IS illuminating.
6. Now turn the adjustment ring of the pressure switch until the LED light is just NOT illuminated. (clockwise)
7. You now have set the pressure switch at a point so that when the pressure drops below the critical set point the switch opens.

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Pallet ID Reader Installation

Mounting Considerations

The Pallet ID Reader would typically be mounted within the machining enclosure with line of sight to the fixture without obstruction by machine operation, spindle park location or being directly subjected to high pressure coolant spray. See the illustrations below.

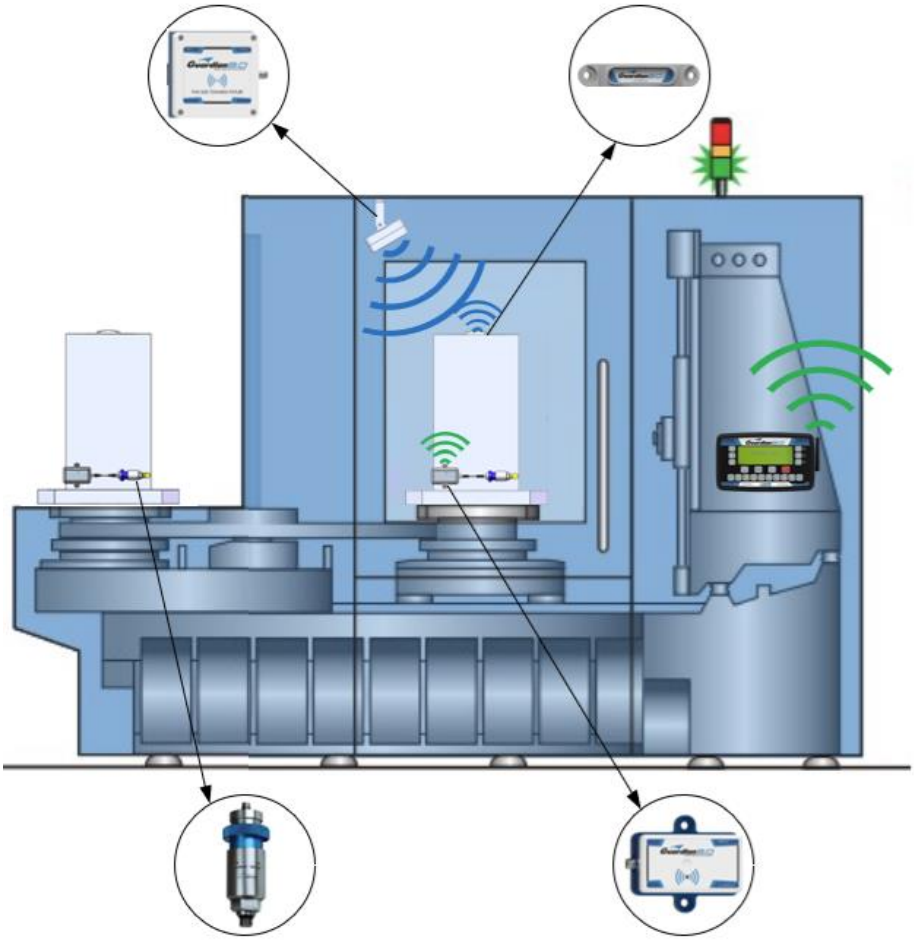


Figure 20: PALLET ID READER MOUNTING LOCATION SUGGESTIONS

Step 1: Use the bracket provided or direct mount the Pallet ID Reader. The mounting dimensions are on the next page. The Pallet ID Reader should be mounted such that when Pallet ID Tags are to be monitored, they are within 6 ft at all times. The dimensions are shown in Figure 21.

Note: The label on the front of the Pallet ID Reader should face the monitor area where the Pallet ID Tag will be located. The Reading Field is broadcast from the face of the Pallet ID Reader in the direction indicated on the label and best practice is for the Pallet ID Reader to be in direct line of sight within 6 ft of the Pallet ID Tag being read.

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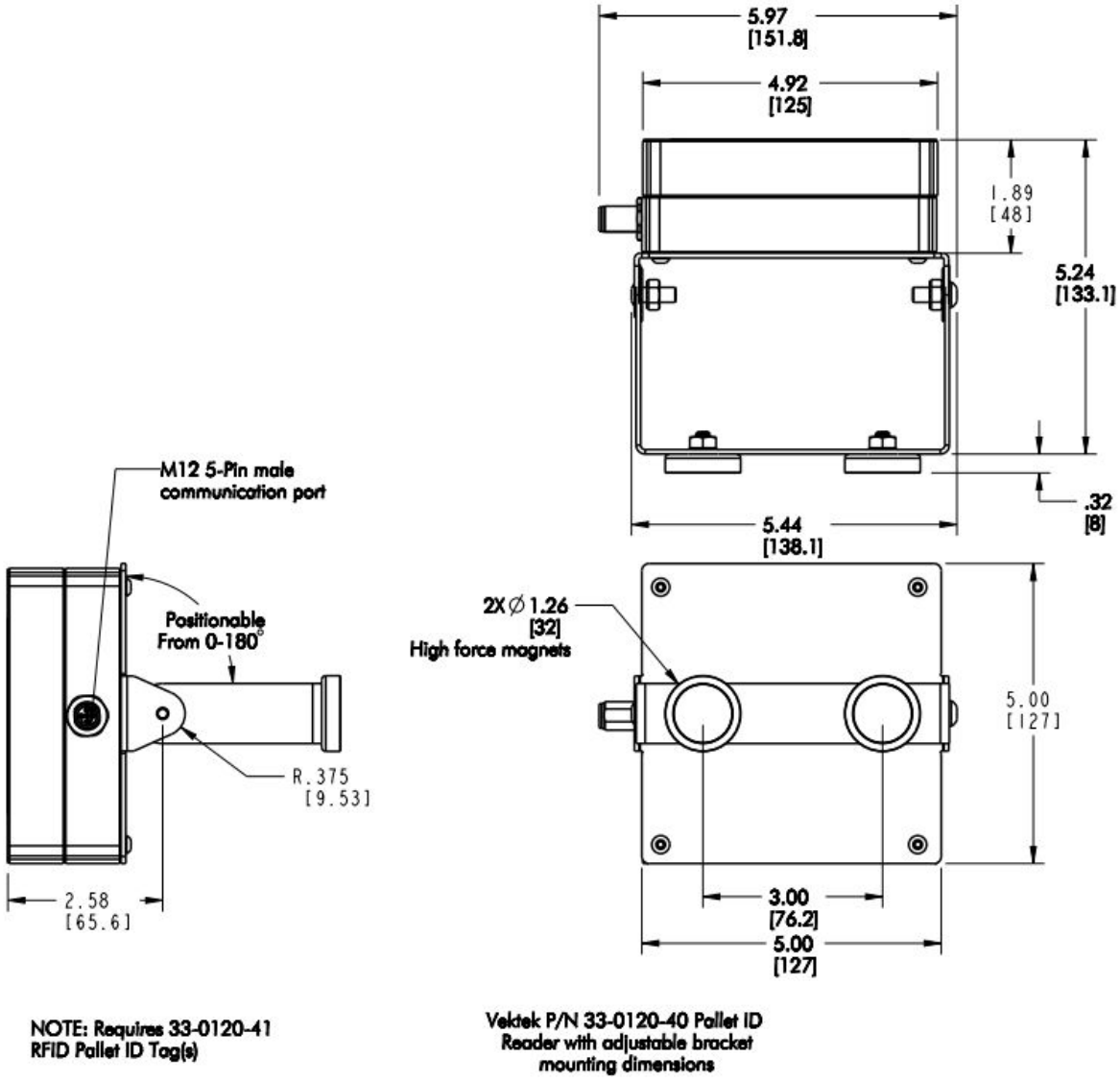


Figure 21: PALLET ID READER MOUNTING DIMENSIONS

Step 2: Route the 5 Pin M12 communication cable to the Master Control unit.

Step 3: With the Pallet ID Reader mounted, connect the female end of the shielded 5 Pin M12 communication cable to the port in the side.

Step 4: Plug the Male M12 Connector into the M12 communication port on the Master Control Unit. Any excess cable can be coiled and hidden somewhere along the cable route.

Note: The communication cable should be routed to prevent contact with moving parts and sharp edges. Also avoiding contact with machine wiring will ensure maximum performance of the system. Also avoid installing near high interference loads like servo motors, spindle motors and other RF/electromagnetic field generators. The minimum bend radius of the cable is 6".

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MASTER CONTROL UNIT Installation

Step 1: Mount the Master Control Unit in a location which permits easy wiring and maintenance. If this location does not allow for wireless communication, purchase a remote mount antenna kit and route it to a location that allows the MCU to contact the various FTU's necessary. The following are dimensions for the mounting holes and possible mounting options please see Figure 22 (Not to scale). The Master Control Unit can also be mounted via a 35mm DIN rail (included)

CAUTION!

NOTE: The MASTER CONTROL UNIT is a sealed unit IP65 rated, not designed to be mounted within the wet machine environment.

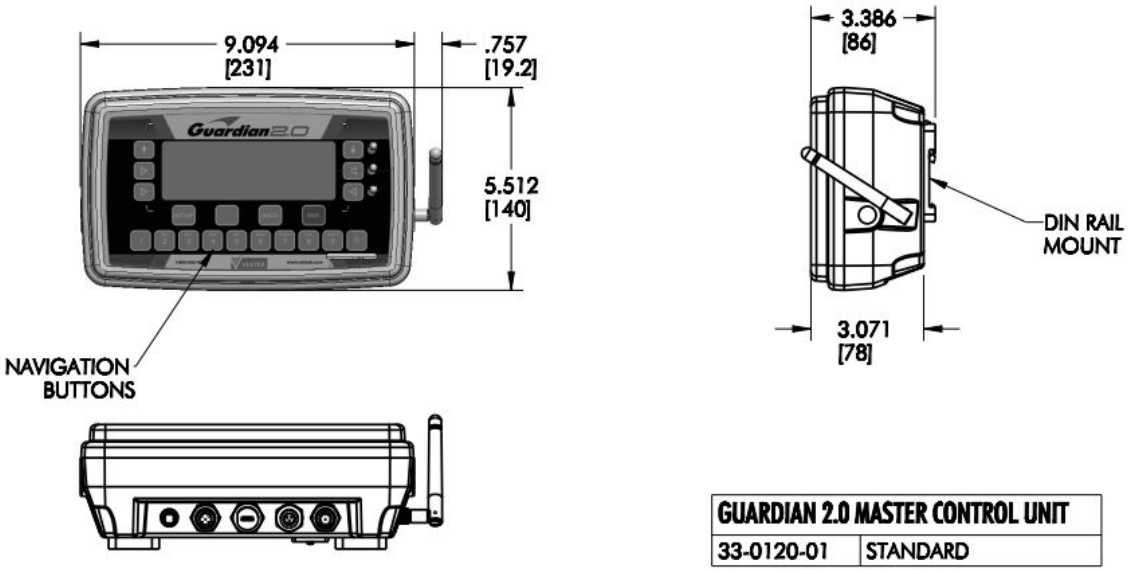


Figure 22: MCU MOUNTING DIMENSIONS

Step 2: Connect the 8 pin M12 cable to the Master Control Unit. Route the cable to machine tool controls electrical enclosure. Find an entrance to the enclosure and determine the longest wire needed. Cut the cable to length and discard the excess. Remove cable outer insulation as needed.

Safety

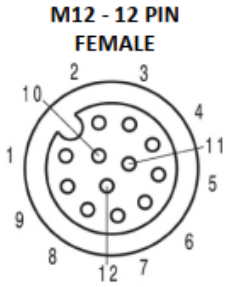
Read and follow the safety guidelines in the Vektek Inch Hydraulic Catalog before proceeding. Be sure **TO *ALWAYS* DISCONNECT POWER AND DISCHARGE HYDRAULIC PRESSURE** before **ANY** service work is started. Be sure to practice **LOCKOUT-TAGOUT** procedures on power sources both electronic and hydraulic.

Step 3: Connect power as instructed in Figure 23.

Step 4: See the Master Control Unit Wiring below to complete installation.

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M12 – 12 Pin Connector Wiring



POWER CONNECTIONS

a. These 4 wires are connected to provide power to the Guardian System
b. Wiring Information
i. Connect wires 1 & 2 (Brown & Blue) to +10-36 VDC
ii. Connect wires 7 & 8 (Black & Gray) to 0 VDC

INPUT PIN FUNCTIONS

a. The In-Cycle input activates the monitoring of the system. A latched signal will need to be provided (wire #3, White) for the output Condition Relay (wire #5, Pink) to switch its state based on the monitored pressure status. Providing this signal will activate the Fixture Transmitter Unit selected by the pallet ID input.
b. Wiring Information
i. For machine outputs providing 24 VDC (PNP)
1. Connect the In-Cycle relay contact, wire # 3 (White) to the machine tool output.
2. Connect the In-Cycle common, wire # 4 (Green) to 0 VDC.
ii. For machine outputs providing 0 VDC (NPN)
1. Connect the In-Cycle relay contact, wire # 3 (White) to the machine tool output.
2. Connect the In-Cycle common, wire # 4 (green) to the +DC source of the control.

GUARDIAN MASTER CONTROL UNIT M12 12 PIN FEMALE CONNECTOR WIRING		
PIN NUMBER	**WIRE COLOR**	**FUNCTION**
1	BROWN	+24 VDC
2	BLUE	+24 VDC
3	WHITE	IN-CYCLE INPUT
4	GREEN	IN-CYCLE COMMON
5	PINK	CONDITION RELAY CONTACT
6	YELLOW	RELAY COMMON
7	BLACK	0 VDC
8	GREY	0 VDC
9	RED	LOW BATTERY RELAY CONTACT
10	VIOLET	COMMUNICATION LOSS RELAY CONTACT
11	GREY/PINK	M-CODE ACKNOWLEDGE RELAY CONTACT
12	RED/BLUE	N/A - UNUSED

Figure 23: M12-12 PIN WIRING

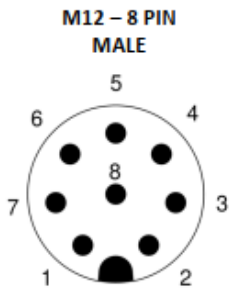
OUTPUT CIRCUITS' FUNCTION

a. The output of the Master Control Unit is dry contact relays. These relays will change their state based on the status of the active Fixture Transmitter Unit.
i. The Condition relay, wire # 5 (pink) toggles in relation to the switch being monitored through the fixture transmitter unit.
ii. The Low Battery relay, wire # 9 (red) toggles when the active Fixture Transmitter Unit batteries drop below 15%.
iii. The Communication Loss relay, wire # 10 (violet) toggles when the Master Control Unit is unable to communicate with the active Fixture Transmitter Unit. During this time, the Condition Relay will de-activate/de-energize.
b. Wiring Information
i. For machine outputs providing 24 VDC (PNP)
1. Connect the output relay contacts, wire # 5, 9, & 10 (Pink, Red, & Violet) to the machine tool inputs.
2. Connect the output circuit common, wire # 6 (Yellow) to the +DC source of the control.
ii. For machine outputs providing 0 VDC (NPN)
1. Connect the output relay contacts, wire # 5, 9, & 10 (Pink, Red, & Violet) to the machine tool inputs.
2. Connect the output circuit common, wire # 6 (Yellow) to 0 VDC.

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Pallet ID Input Options

The pallet ID selection informs the Guardian Master Control Unit which pallet to actively monitor. This selection can be provided in 2 different methods, the Pallet ID inputs or the Pallet ID Reader upgrade. Each Guardian integration will use one approach or the other.



Method 1 – Pallet ID Input

This approach uses an M12 8-pin cable to provide 6 discrete signals to the Master Control Unit. These 6 discrete signals are based on a 6-digit binary counting scheme. This allows for 64 pallets to be selected. This binary can be seen by referencing Figure 25. When the In-Cycle input is provided to the Master Control Unit, the associated Fixture Transmitter associated with the binary number provided would activate. Note that the cable for this method is provided with each Master Control Unit kit.

GUARDIAN PALLET ID UNIT M12 8 PIN MALE CONNECTOR WIRING		
FUNCTION	**WIRE COLOR**	**PIN NUMBER**
PALLET ID 1	WHITE	1
PALLET ID 2	BROWN	2
PALLET ID 3	GREEN	3
PALLET ID 4	YELLOW	4
PALLET ID 5	GRAY	5
PALLET ID 6	PURPLE	6
PALLET ID COMMON	BLUE	7
N/A / SHIELDEDING OVDC	RED	8

Figure 24: M12 8-PIN WIRING

Wiring Information

1. For machine outputs providing 24 VDC (PNP)
    a. Connect the Input ID contacts, wire # 1 through 6 (White, Brown, Green, Yellow, Gray, & Purple) to the machine tool output.
    b. Connect the Input ID common, wire # 7 (Blue) to 0 VDC.
2. For machine outputs providing 0 VDC (NPN)
    c. Connect the Input ID contacts, wire # 1 through 6 (White, Brown, Green, Yellow, Gray, & Purple) to the machine tool output.
    d. Connect the Input ID common, wire # 7 (Blue) to the +DC source of the control.

Method 2 – Pallet ID Reader (Sold separately from Master Control Unit kit)

This approach uses the Pallet ID Reader upgrade kit to wirelessly read the Pallet ID tag in the field of view. This information is provided to the Master Control Unit. When the In-Cycle input is provided to the Master Control Unit, the paired Fixture Transmitter Unit would activate.

Wiring Information

1. The shielded M12 5-pin cable will be routed and connected to the Pallet ID Reader and the Master Control unit.

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PALLET ID # REQUIREMENTS								PALLET ID # REQUIREMENTS							
Pallet #	Binary	Pallet ID 6	Pallet ID 5	Pallet ID 4	Pallet ID 3	Pallet ID 2	Pallet ID 1	Pallet #	Binary	Pallet ID 6	Pallet ID 5	Pallet ID 4	Pallet ID 3	Pallet ID 2	Pallet ID 1
1	000000	OFF	OFF	OFF	OFF	OFF	OFF	33	100000	ON	OFF	OFF	OFF	OFF	OFF
2	000001	OFF	OFF	OFF	OFF	OFF	ON	34	100001	ON	OFF	OFF	OFF	OFF	ON
3	000010	OFF	OFF	OFF	OFF	ON	OFF	35	100010	ON	OFF	OFF	OFF	ON	OFF
4	000011	OFF	OFF	OFF	OFF	ON	ON	36	100011	ON	OFF	OFF	OFF	ON	ON
5	000100	OFF	OFF	OFF	ON	OFF	OFF	37	100100	ON	OFF	OFF	ON	OFF	OFF
6	000101	OFF	OFF	OFF	ON	OFF	ON	38	100101	ON	OFF	OFF	ON	OFF	ON
7	000110	OFF	OFF	OFF	ON	ON	OFF	39	100110	ON	OFF	OFF	ON	ON	OFF
8	000111	OFF	OFF	OFF	ON	ON	ON	40	100111	ON	OFF	OFF	ON	ON	ON
9	001000	OFF	OFF	ON	OFF	OFF	OFF	41	101000	ON	OFF	ON	OFF	OFF	OFF
10	001001	OFF	OFF	ON	OFF	OFF	ON	42	101001	ON	OFF	ON	OFF	OFF	ON
11	001010	OFF	OFF	ON	OFF	ON	OFF	43	101010	ON	OFF	ON	OFF	ON	OFF
12	001011	OFF	OFF	ON	OFF	ON	ON	44	101011	ON	OFF	ON	OFF	ON	ON
13	001100	OFF	OFF	ON	ON	OFF	OFF	45	101100	ON	OFF	ON	ON	OFF	OFF
14	001101	OFF	OFF	ON	ON	OFF	ON	46	101101	ON	OFF	ON	ON	OFF	ON
15	001110	OFF	OFF	ON	ON	ON	OFF	47	101110	ON	OFF	ON	ON	ON	OFF
16	001111	OFF	OFF	ON	ON	ON	ON	48	101111	ON	OFF	ON	ON	ON	ON
17	010000	OFF	ON	OFF	OFF	OFF	OFF	49	110000	ON	ON	OFF	OFF	OFF	OFF
18	010001	OFF	ON	OFF	OFF	OFF	ON	50	110001	ON	ON	OFF	OFF	OFF	ON
19	010010	OFF	ON	OFF	OFF	ON	OFF	51	110010	ON	ON	OFF	OFF	ON	OFF
20	010011	OFF	ON	OFF	OFF	ON	ON	52	110011	ON	ON	OFF	OFF	ON	ON
21	010100	OFF	ON	OFF	ON	OFF	OFF	53	110100	ON	ON	OFF	ON	OFF	OFF
22	010101	OFF	ON	OFF	ON	OFF	ON	54	110101	ON	ON	OFF	ON	OFF	ON
23	010110	OFF	ON	OFF	ON	ON	OFF	55	110110	ON	ON	OFF	ON	ON	OFF
24	010111	OFF	ON	OFF	ON	ON	ON	56	110111	ON	ON	OFF	ON	ON	ON
25	011000	OFF	ON	ON	OFF	OFF	OFF	57	111000	ON	ON	ON	OFF	OFF	OFF
26	011001	OFF	ON	ON	OFF	OFF	ON	58	111001	ON	ON	ON	OFF	OFF	ON
27	011010	OFF	ON	ON	OFF	ON	OFF	59	111010	ON	ON	ON	OFF	ON	OFF
28	011011	OFF	ON	ON	OFF	ON	ON	60	111011	ON	ON	ON	OFF	ON	ON
29	011100	OFF	ON	ON	ON	OFF	OFF	61	111100	ON	ON	ON	ON	OFF	OFF
30	011101	OFF	ON	ON	ON	OFF	ON	62	111101	ON	ON	ON	ON	OFF	ON
31	011110	OFF	ON	ON	ON	ON	OFF	63	111110	ON	ON	ON	ON	ON	OFF
32	011111	OFF	ON	ON	ON	ON	ON	64	111111	ON	ON	ON	ON	ON	ON

Figure 25: PALLET ID BINARY LOGIC

M8 – 3 Pin Connector Wiring (For RS-232)

The RS-232 Serial Interface provides an interface for the Guardian System to communicate to the machine controller, pallet handling system or automation controller to wireless identify which pallet is being read in the working area. The Guardian System reads through wireless technology all the Fixture Transmitter Units (FTU) in range and will use an internal algorithm to determine which reporting unit is closest to the Pallet ID Reader that has been mounted in the working area. Then depending on the users selection in Settings in the Master Control Unit (MCU), the FTU factory unique number will be sent over the serial communications port. Either based on time, operational state or via a serial command sent to the MCU from the Machine Controller.

Software Settings

The Master Control Unit(MCU) determines the operation of the optional Serial Communications port feature. This is done through the system settings menu selections as described in Figure 63.
There are 4 possible modes of operation:
Mode 0: All Serial output and input monitoring is ignored.
Mode 1: Every time the MCU detects an FTU with good pressure, the unique serial number of the FTU is sent out the Serial Communications Port.
Mode 2: Every 3-5 seconds the MCU sends out the FTU that has been detected as the closest FTU to the MTR as defined by the internal algorithm. The message will be sent with no less than 3 seconds and no more than 5 seconds depending on other internal tasks to the MCU system with higher priorities.
Mode 3: When the MCU receives a message on the Receive pin of the communications port that matches the Request format, the MCU will reply with the FTU that has been detected as the closest FTU to the MTR as defined by the internal algorithm.

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Wiring Information

The connections for the optional Serial Communications port are thru the female M8-3 pin connector on the bottom of the MCU. The three pin connections are Transmit (TX), Receive (RX) and Signal Common.
The signal voltage levels are industry standard RS-232. It is recommended that any cable connections longer than three meters or routed near devices that generate large EMI sources, use shielded cables that are grounded at the Machine Controller.

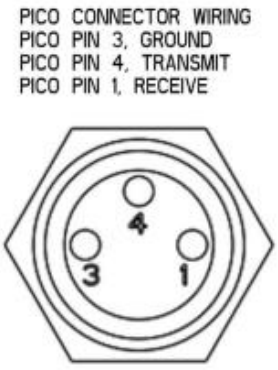


Figure 26: M8-3 PIN WIRING

Communications

The Protocol specifications for the optional Serial Communications port are as follows:

Baud Rate	Data bits	Parity Bit	Stop Bits
19,200	8	None	1

The message transmitted will be in the format of four digits followed by carriage return and linefeed.
For Example: 0048<CR><LF>

The unique FTU ID serial number has many more digits than are shown on the LCD screen of the MCU and is transmitted on the optional Serial Communications port. Only the four last digits are transmitted. If there is no Pallet ID being read then the MCU sends four zeros '0000<CR><LF>' as described above when normal, based on the Mode selected in the MCU.

Serial Request for FTU Number

The MCU when set in Mode 3 will monitor the Serial Communications port looking for a single character to request data. When the 'R' (ASCII 82 decimal) character is detected on the receive port, the MCU will send the current FTU number in the format as described above.

PALLET ID TAG Installation

It is recommended that the Pallet ID Tag be installed in direct line of sight with the Pallet ID Reader on a metal surface. See Figure 27 for mounting dimensions.

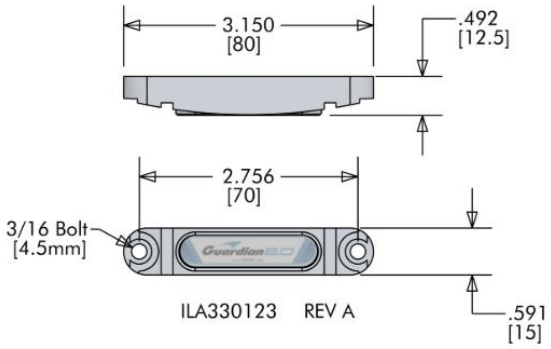


Figure 27: PALLET ID TAG MOUNTING DIMENSIONS

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Guardian Accessory Parts and Dimensions

GUARDIAN ACCESSORIES				
Cables				
Model No.	**Description**	**Connection**	**Length**	
			Meters	**Feet**
27-7424-06	Cable, M12 8-Pin Master Control Unit Pallet ID Machine Tool Interface Cable*	Male Straight	5	16.4
27-9422-01	Extension Cable M12 5-Pin Master Control Unit to Pallet ID Receiver Communication Cable	Female Straight - Male Straight	10	32.8
27-7422-05			5	16.4
27-7424-02	Extension Cable M8 3-Pin Shielded Pressure Switch to Fixture Transmitter	Female Straight - Male Straight	1	3.3
27-7424-01			.6	2.0
27-7424-04			.3	1.0
27-7424-03		Male 90° - Female 90°	.5	1.6
27-7424-05	Cable M12 12-Pin Master Control Unit main system interface cable*	Female Straight	5	16.4
27-5424-00	Cable, RS-232 Pallet Selected*	M8 3 Pin	5	16.4
Pressure Switches				
70-7500-78	750-5000PSI Pressure Switch with 19.7 Inch Cable (Shown)			
70-7500-74	750-5000PSI Pressure Switch with M8 Male Connection Only **			
33-0110-15	Pressure Setter / Checker to assist setting mechanical pressure switches			
Connectors				
27-5222-04	Guardian, M8 3-Pin Pressure Switch Bypass, used with 27-8422-05 when 3 Pressure Switch circuits are desired			

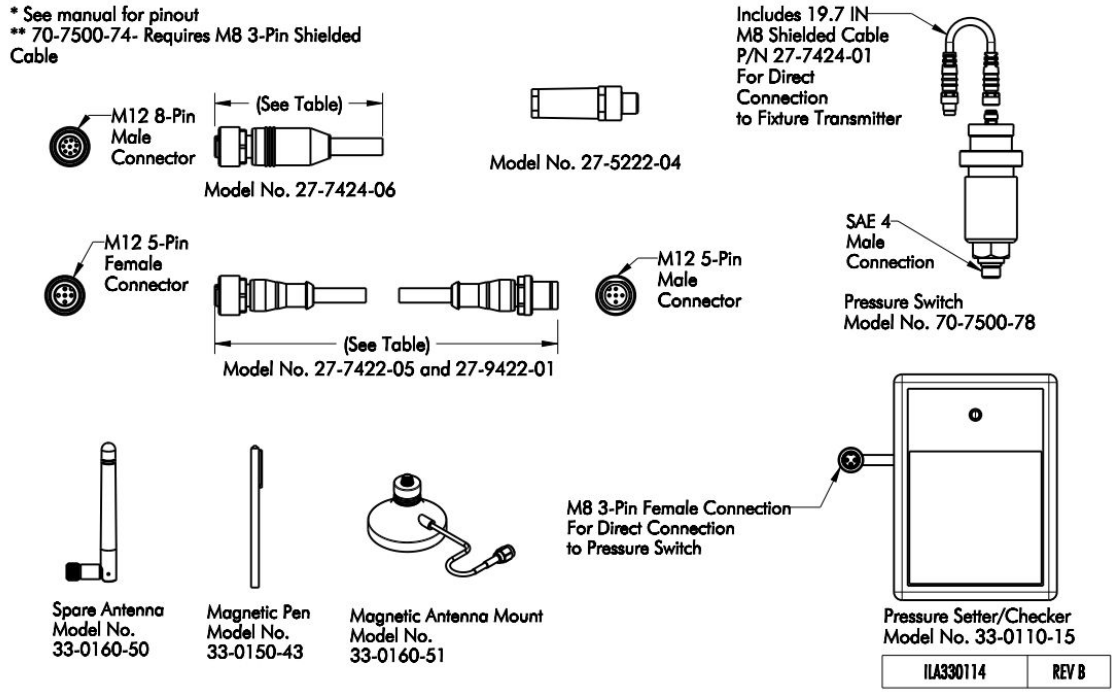


Figure 28: GUARDIAN 2.0 ACCESSORIES

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QUICK START GUIDE

There are two different ways to process the Pallet ID using the Guardian 2.0 System. The two options are either to use a Pallet ID Reader, or binary code through the M12-8Pin connection on the MCU. These methods are described in detail in the section of this manual: "Pallet ID Input Options" above. Setting the MCU will vary dependent upon which of these methods you use.

Method 1 – Pallet ID Binary Input

STEP 1: Go to the Admin menu on the MCU and select "Inputs" under the In-Cycle settings menu. See Figure 58.

STEP 2: Decide if the FTU input needs to be normally open or normally closed. The default setting is normally open. If you are using a Vektek Pressure switch or a NO customer supplied pressure switch this setting does not need to be changed.

STEP 3: Add new pallets through the "Pal Menu" using either "Setup" for new FTU's which need to be tied to their respective pallets numbers, "Add" for FTU's which have already been tied to their pallets numbers by any MCU, or "add manual" for pallets that don't have any pressure monitoring. See pages 28-29 for more information.

Method 2 – Pallet ID Reader

STEP 1: Go to the Admin menu on the MCU and select "RFID SCAN" under the In-Cycle settings menu. See Figure 58.

STEP 2: Decide if the FTU input needs to be normally open or normally closed. The default setting is normally open. If you are using a Vektek Pressure switch or a NO customer supplied pressure switch this setting does not need to be changed.

STEP 3: Modify the RFID settings to provide reliable feedback for your machine. See Pages 36-37 for a menu walkthrough.

STEP 4: Run a test RFID reading by setting up a fixture in the work area and pressing "Test Read". See Figure 65 and Figure 66. If the Pallet ID Tag fails to read go back to Step 3 and increase your power level.

STEP 5: Add new pallets through the "Pal Menu" using either "Setup" for new FTU's which need to be tied to their respective pallets numbers, "Add" for FTU's which have already been tied to their pallets numbers by any MCU, or "add manual" for pallets that don't have any pressure monitoring. See pages 28-29 for more information.

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Operation/Menu Overview

Startup Screens

Upon powering up the Guardian 2.0 System, you will see the following four screens. Pay close attention to the third screen as it displays the current software version and last update date of your MCU. This can be beneficial for communicating and diagnosing issues with the factory.



Figure 29: SCREEN: VEKTEK LLC



Figure 30: SCREEN: GUARDIAN 2.0



Figure 31: SCREEN: VERSION No.

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Figure 32: SCREEN: WELCOME

After Startup you will be taken to the "Idle Mode" Menu. This menu is described in detail in the "Idle Mode Menu" section below. If you are starting your system for the first time, or after a factory reset, the idle screen will likely be blank like the picture below.



Figure 33: SCREEN: IDLE MODE

Pallet Menu

The pallet menu on the MCU is where a user can store, wake, add, or delete pallets in the MCU memory. To access this menu press the "SETUP" button. That will display the "Menu" Page.



Figure 34: SCREEN: MAIN MENU

From the menu page pressing the arrow button next to "Pal Menu", will take you to the Pallet Menu. The pallet menu looks like this.



Figure 35: SCREEN: PALLET MENU

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To add a pallet to the MCU press the arrow button by "Add".

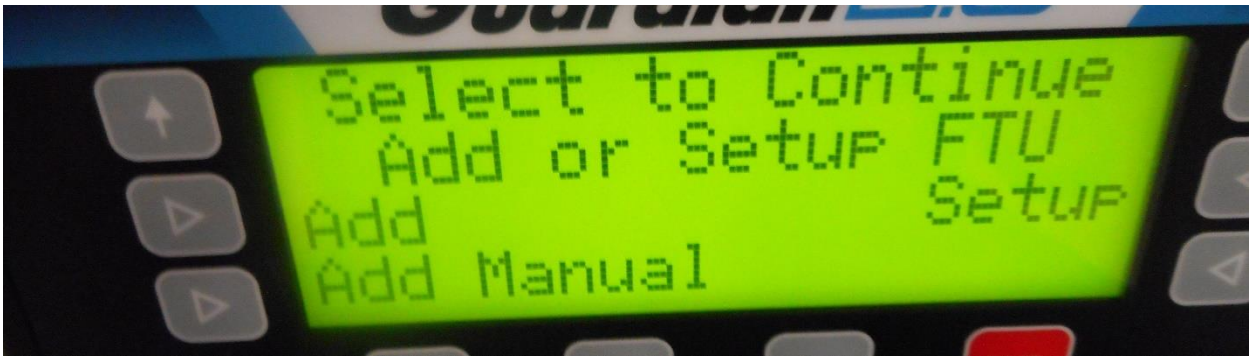


Figure 36: SCREEN: ADD MENU

From this sub menu you can either "Setup" a new pallet ID tag with FTU, "Add" an FTU directly, or "Add Manual" a pallet that only has a Pallet ID Tag. Below are the procedures for adding a new pallet to the system.

	SETUP: For pairing new (never paired) FTUs or changing FTU number	**ADD:** Adding previously paired FTU to a second MCU	**ADD MANUAL:** Adding manual tags
PALLET ID TAGS WITH PALLET ID READER	**Method 1: Scan Method** • Place tag in range of Pallet ID Reader • Hold magnet on FTU to illuminate LED • Press "Scan" **Method 2: Enter Method** • Type in unit number marked on tag • Hold magnet on FTU to illuminate LED • Press "Enter"	**Method 1: Scan Method** • Place tag in range of Pallet ID Reader • Hold magnet on FTU to illuminate LED • Press "Scan" **Method 2: Enter Method** • Enter a known FTU number • Hold magnet on FTU to illuminate LED • Press "Enter"	**Method 1: Scan Method** • Place manual tag in range of Pallet ID Reader • Press "Scan" **Method 2: Enter Method** • Type in unit number marked on tag • Press "Enter"
PALLET ID WITH M12 BINARY INPUTS	**Method 1: Enter Method** • Type in NEW (user defined) number to be programed • Hold magnet on FTU to illuminate LED • Press "Enter	**Method 1: Enter Method** • Type in NEW (user defined) number to be programed • Hold magnet on FTU to illuminate LED • Press "Enter	

Figure 37: ADDING PALLET OPTIONS

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Adding a New Pallet

1. Start by pressing the arrow by "Setup" in the screen above

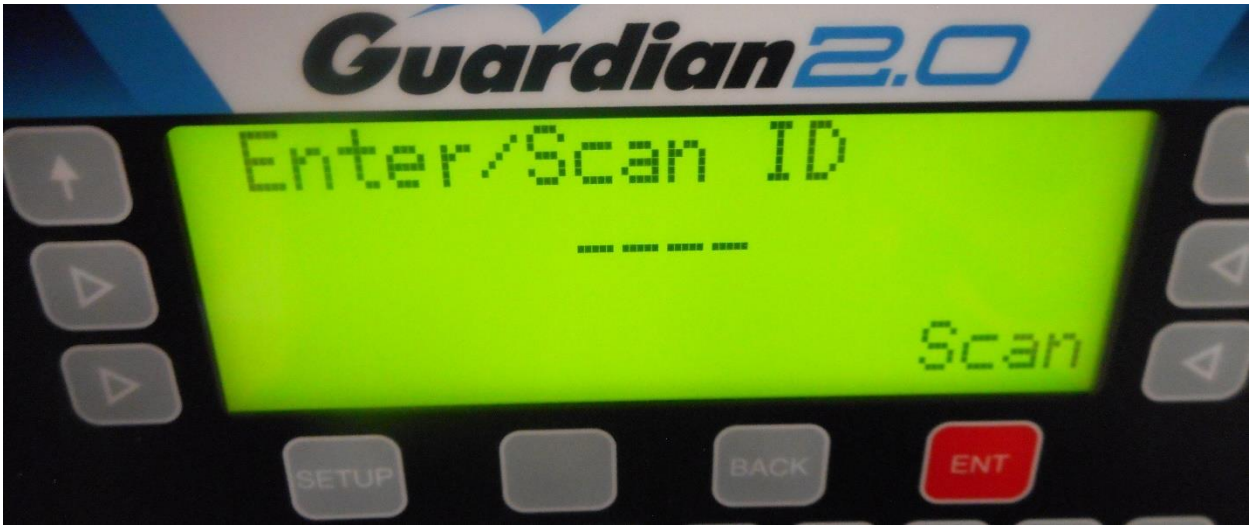


Figure 38: SCREEN: SETUP MENU

2. If setting up with a Pallet ID Tag. Make sure the ID tag is within line of sight of the Pallet ID Reader and press Scan. The screen will then briefly show the Pallet ID Tag information and will begin searching for the FTU. At this point it is important that you are holding the magnetic pen over the light on the FTU so that the light is shining constantly. Keep the magnetic pen there until pairing is successful.



Figure 39: SCREEN: "SCANNING"



Figure 40: SCREEN: "SCANNED ID"

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Figure 41: SCREEN: "CONTACTING"

3. After the pairing is complete, the MCU will ask what position on the idle screen you want the new FTU to be stored in. Select any position you want by hitting the arrow key next to the desired screen location.



Figure 42: SCREEN: "PALLET POSTION"

4. If the setup was successful, you should now be able to see the recently added FTU on the "Idle Mode" Menu. (Press the back key multiple times to get to this menu.)



Figure 43: SCREEN: IDLE MODE MENU WITH PALLET

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Wake a Pallet

If a Pallet has been "Stored" in the MCU memory, it can be restored by "Waking" it up. To wake a pallet:

1. Press the arrow key by "Wake" from the Pallet Menu. This brings you to the "Wake Pal" menu. Press the arrow key next to the pallet you want "Woken" and the system will communicate with the FTU waking it up. The pallet is now ready for standard service again.



Figure 44: SCREEN: WAKE PAL MENU

Store a Pallet

If you would like a pallet taken out of standard service and removed from the home screen but want it saved for future use, the option exists to "Store" a pallet in the MCU memory.

1. Press the arrow key by "Store" from the pallet Menu. This brings you to the "Store Pallet" menu. Press the arrow key next to the pallet you want "Stored" and the system will communicate with the FTU and place the Pallet in "Storage". You can undo this action by following the "Wake a Pallet" procedures



Figure 45: SCREEN: STORE PAL MENU

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Delete a Pallet

If a pallet is no longer needed in the MCU memory. You can delete it by following these procedures.

1. Press the arrow key by "Delete" from the pallet Menu. This brings you to the "Delete Pal" menu. Press the arrow key next to the pallet you want Deleted and the system will communicate with the FTU and remove it from memory. If needed, deleted Pallets would need to be readded using the "Adding a Pallet" procedures above.



Figure 46: SCREEN: DELETE PALLET MENU

Idle Mode Menu

The "Idle Mode" Menu acts like the home screen for the Guardian 2.0 System. This is the first screen you should see once the MCU is fired up and it allows you to check on the status of every pallet that has been added to the system. Here is an example where the Pallet in the No.1 position has no pressure and the Pallet in the No.3 position has pressure.



Figure 47: SCREEN: IDLE MODE MENU TWO PALLETS

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For more information on a pallet, you can press the arrow key next to it. This shows the battery charge percentage of the FTU, the Pallet ID number, and the pressure status.



Figure 48: SCREEN: PALLET INFO. MENU

Admin Menu

The Admin Menu on the MCU allows the user to perform some diagnostic tests, and other higher level system functions. To access this menu press the "SETUP" button. That will display the "Menu" Page. Than press the arrow by "Admin Menu".



Figure 49: SCREEN: MAIN MENU 2

From the Admin Menu Screen you can perform "Diagnostic" tests, do a factory "Reset", or change RFID, In-Cycle, or FTU input settings



Figure 50: ADMIN MENU

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Diagnostic Tests

The Guardian MCU has multiple internal diagnostic tests which can be performed for troubleshooting. To access these tests press the arrow key by "Diagnostic".



Figure 51: SCREEN: SELECT TEST MENU

Input Test

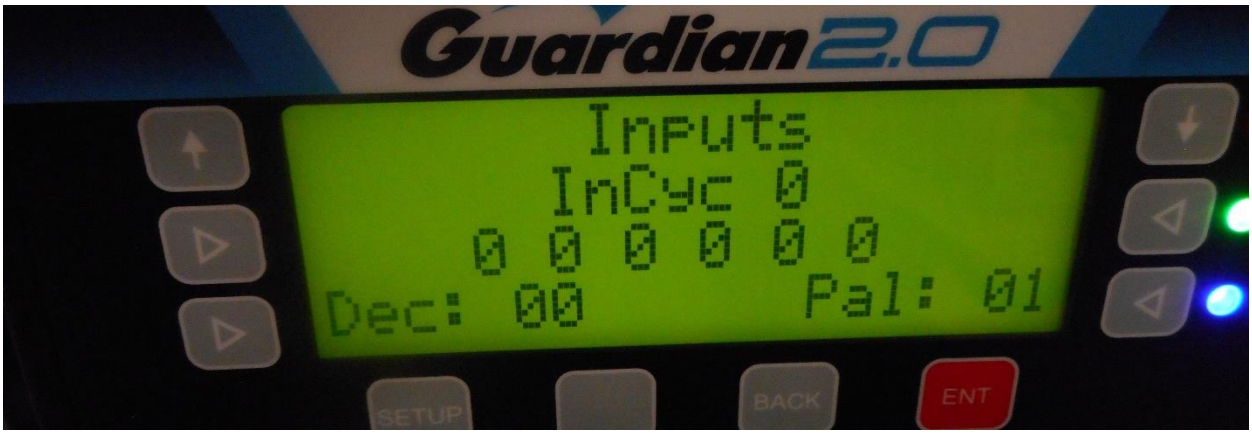


Figure 52: SCREEN: INPUT MENU

Relay Test



Figure 53: SCREEN: RELAY MENU

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Comm Test



Figure 54: SCREEN: COMM TEST MENU

Keypad Test

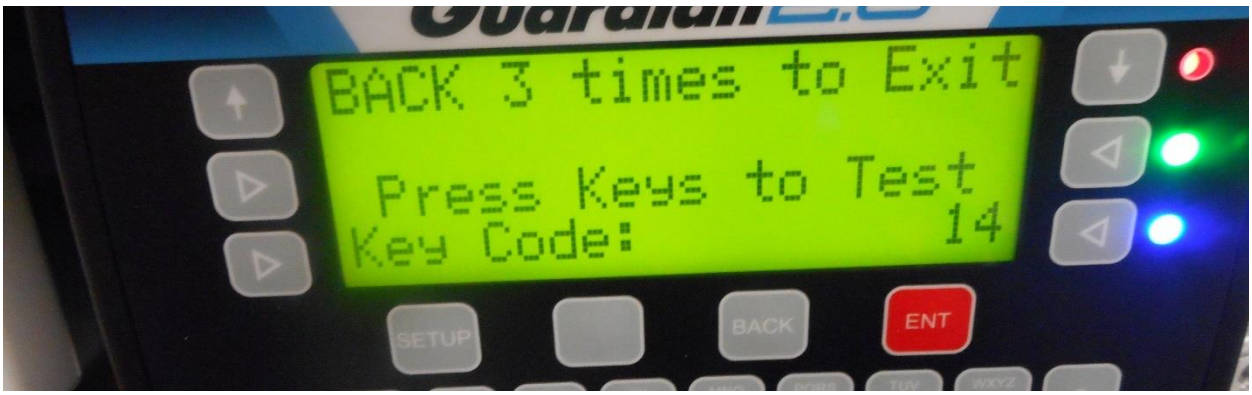


Figure 55: SCREEN: KEYPAD TEST MENU

Screen Test



Figure 56: SCREEN: SCREEN TEST ALL

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Figure 57: SCREEN: SCREEN TEST BLANK

Change the In-Cycle Setting (RFID/INPUTS)



Figure 58: SCREEN: IN-CYCLE MENU

Change the FTU Input Setting (NO/NC)

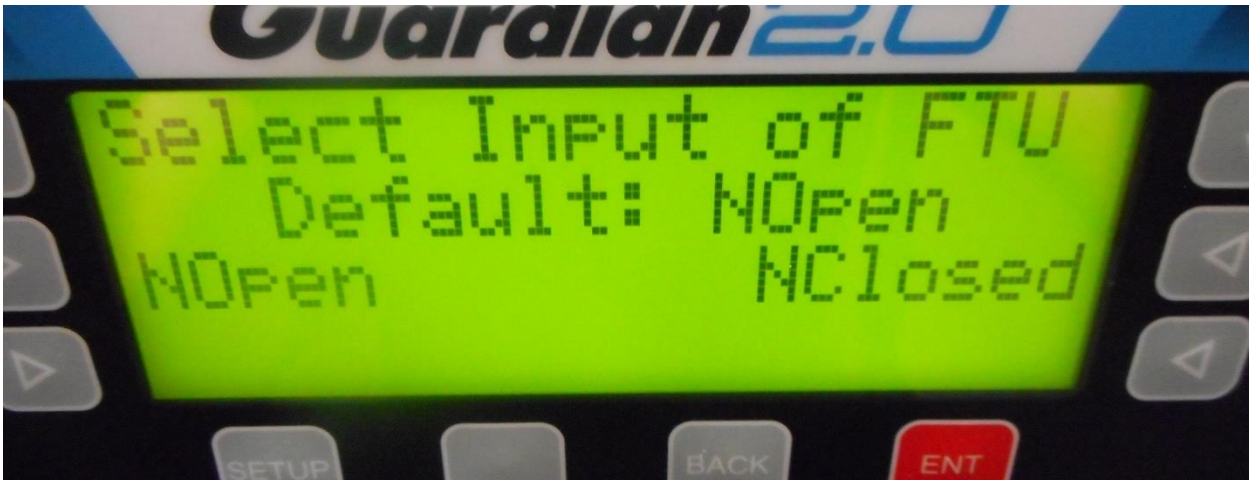


Figure 59: SCREEN: FTU INPUT SETTING MENU

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Change RFID Settings

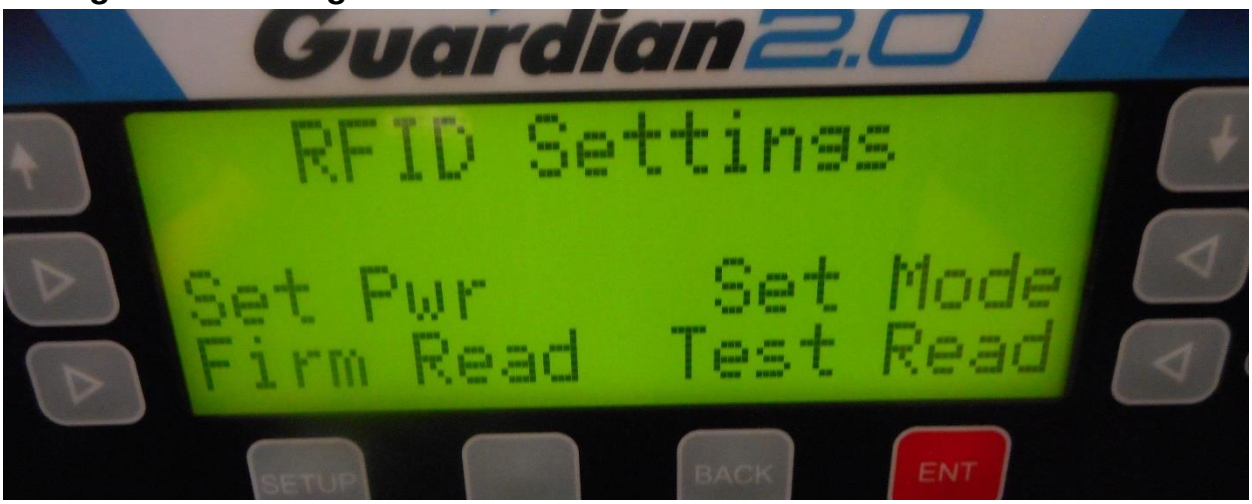


Figure 60: SCREEN: RFID SETTINGS MENU

Set Pwr



Figure 61: SCREEN: SET PWR MENU

Firm Read



Figure 62: SCREEN: "FIRMWARE VERSION"

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Set Mode

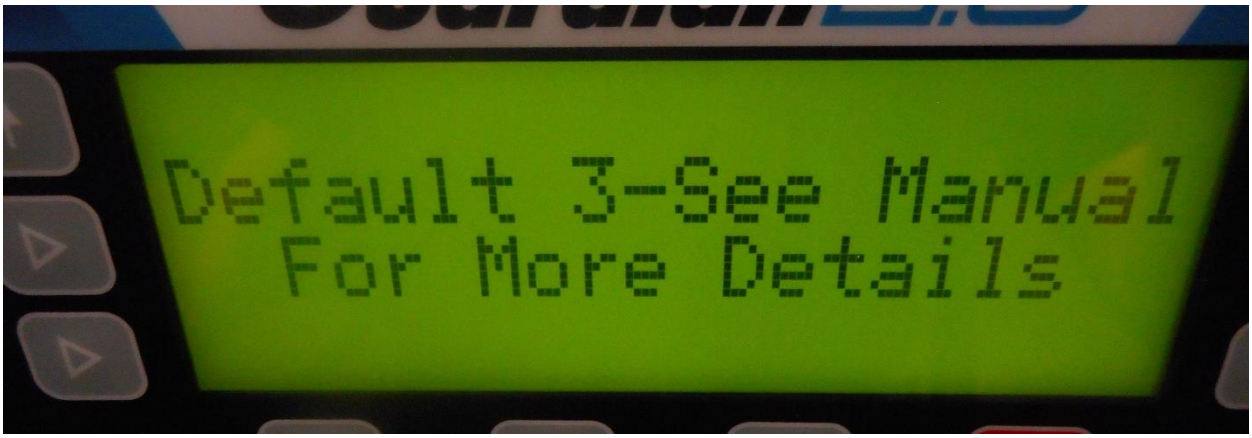


Figure 63: SCREEN: "DEFAULT SET MODE"



Figure 64: SCREEN: ENTER SET MODE MENU

Test Read



Figure 65: SCREEN: "SCANNING" 2



Figure 66: SCREEN: "SCANNED" 2F

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Signal Logic/Timing

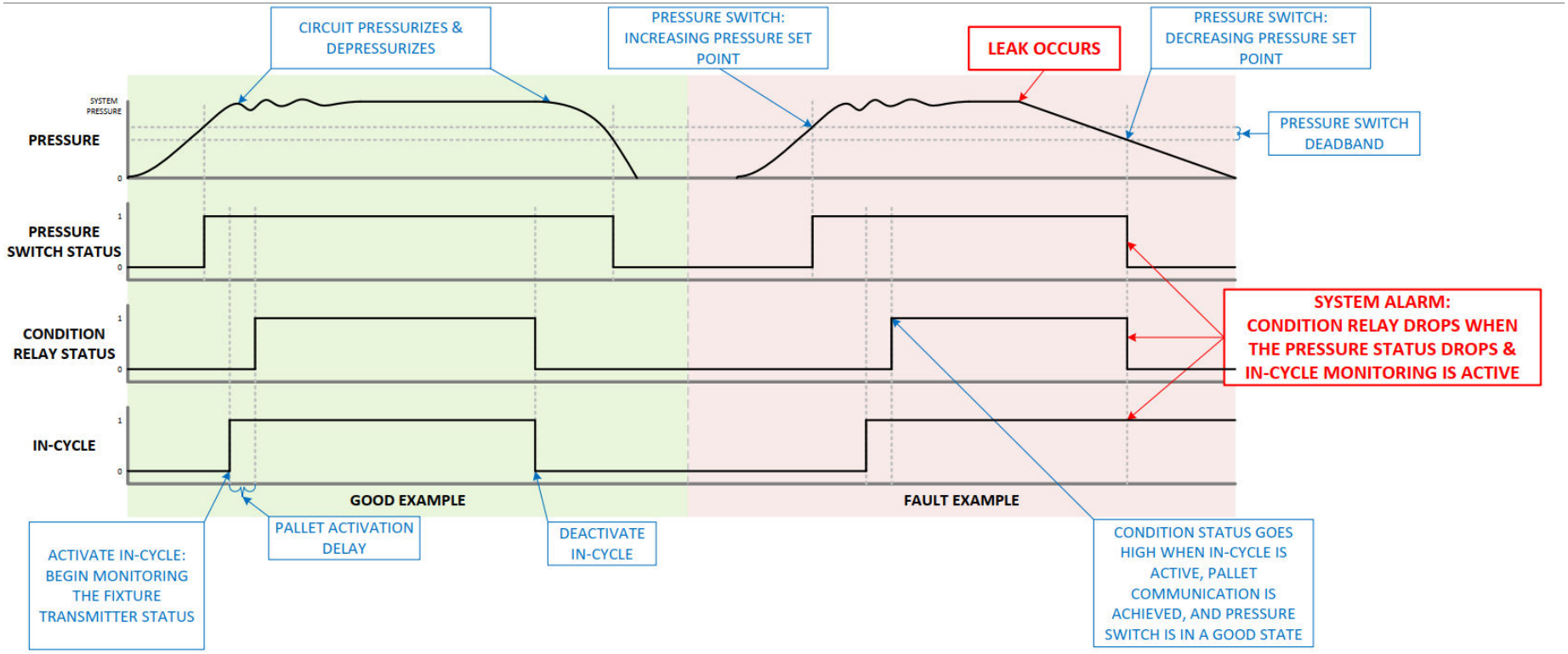


Figure 67: SIGNAL LOGIC

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Typical System Examples

Single Pallet

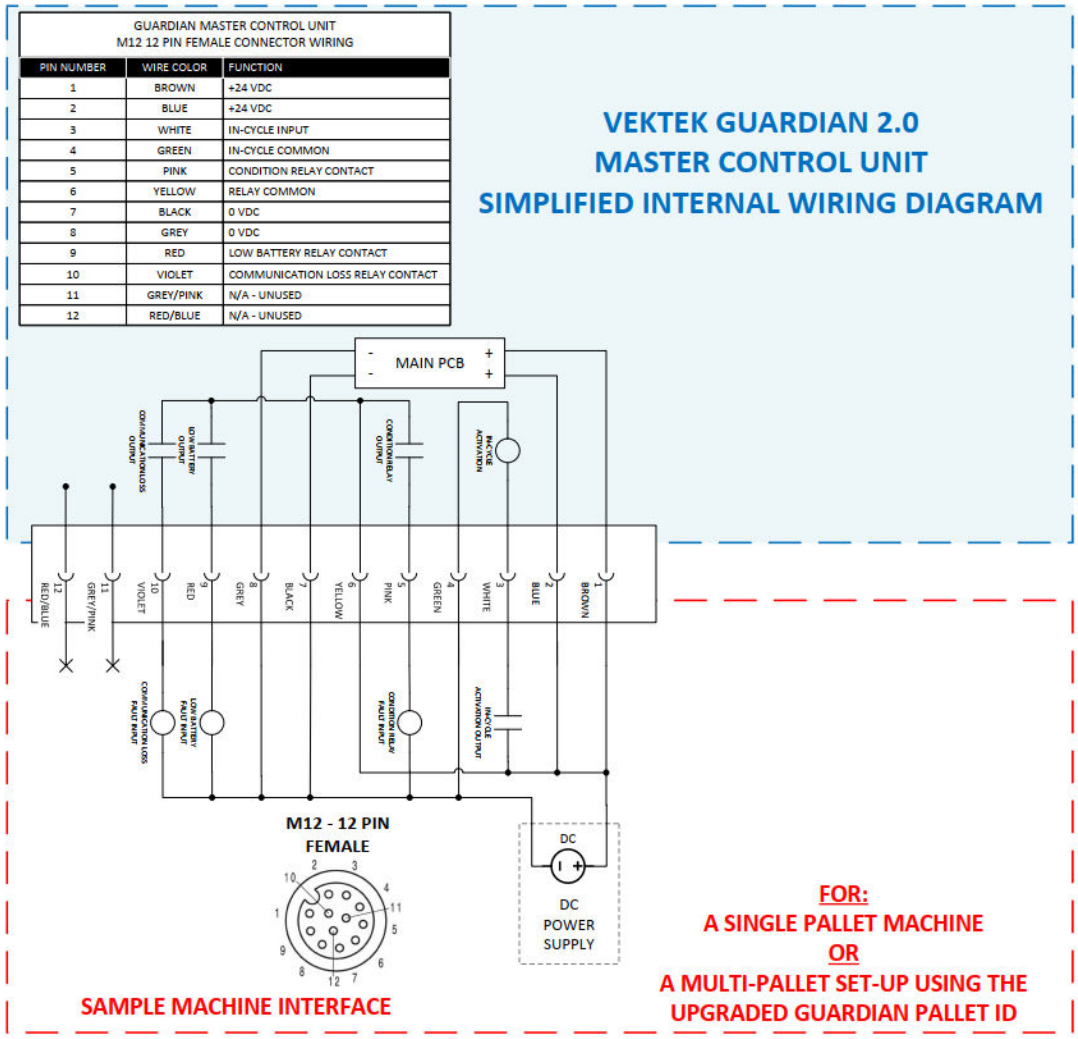


Figure 68: BASIC SINGLE PALLET MASTER WIRING DIAGRAM

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Twin Pallet

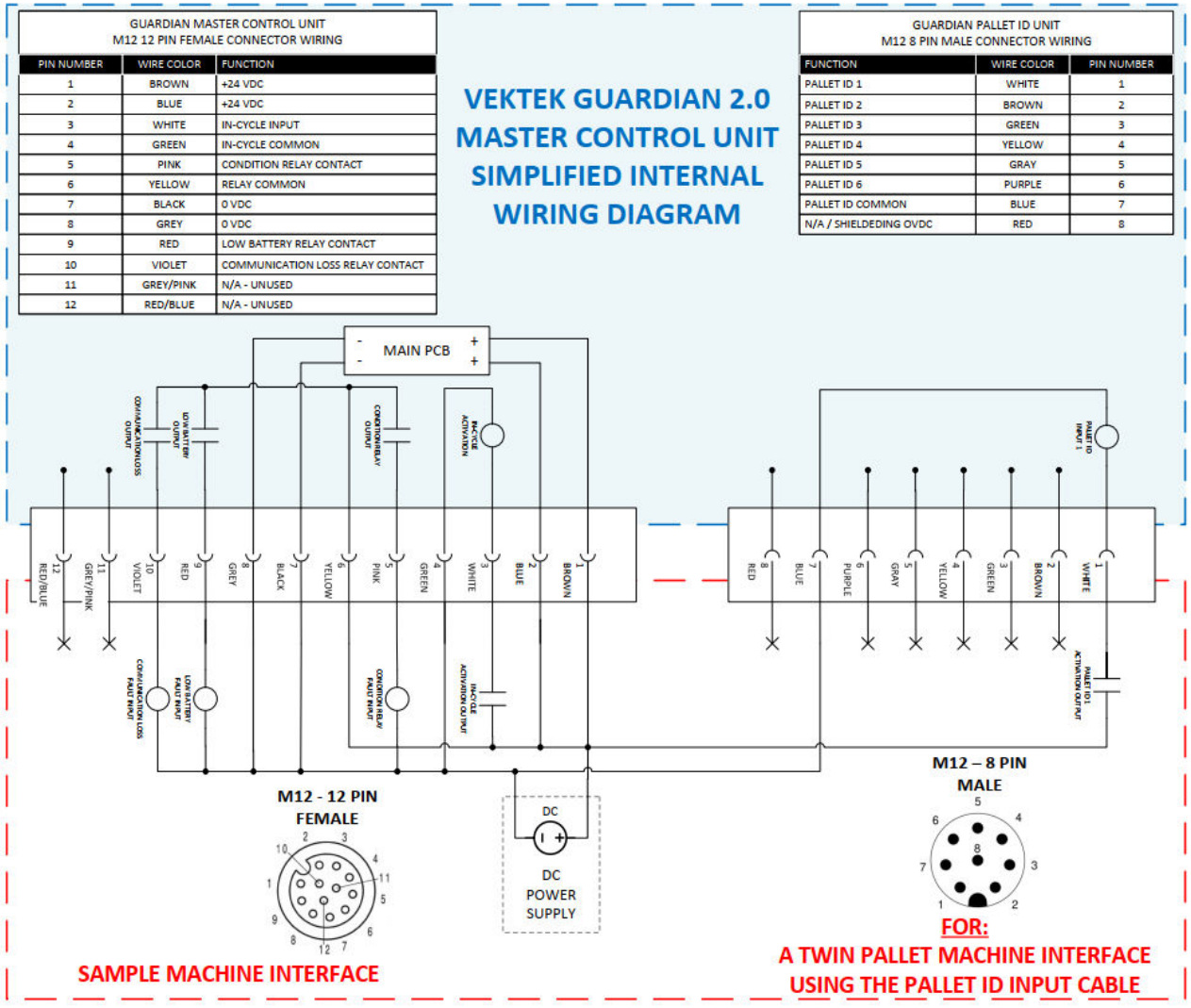


Figure 69: BASIC DUAL PALLET MASTER WIRING DIAGRAM

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Pallet Pools

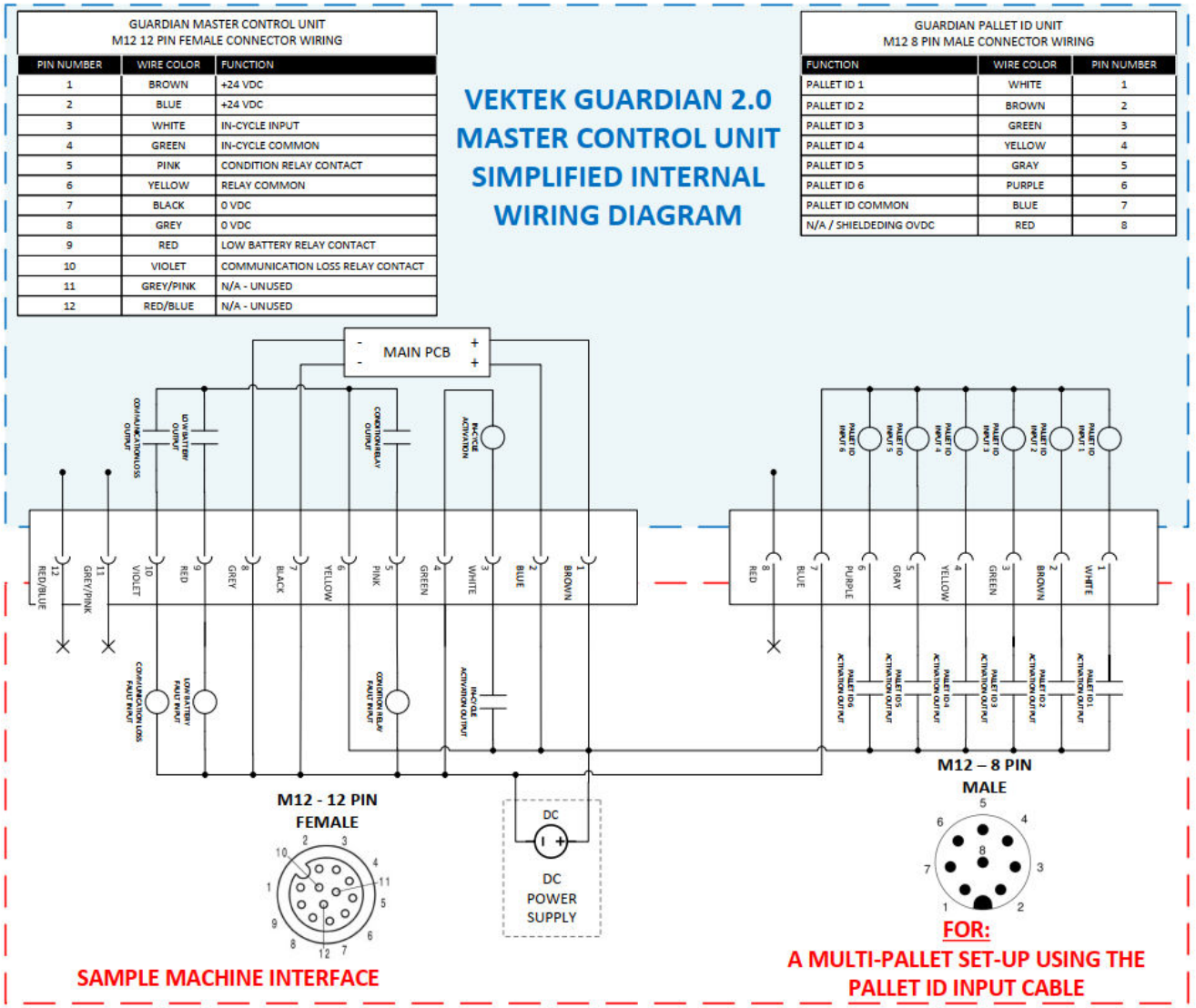


Figure 70: BASIC QUAD PALLET MASTER WIRING DIAGRAM

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Specifications

Guardian Specification Chart			
MCU P/N 33-0120-01	**Power**	***Negative Case Ground***	+10-36 VDC
	Frequency		900 MHz
	Connection	*Power & Inputs/Outputs*	M12-12PIN
	Cable		32.8ft
	Fixture Transmitter Capacity		64 For Discrete I/O 200 For Pallet ID Reader
	Inputs	*Number*	1
		Type	Sourcing/Sinking
		Rating	10-36 VDC
	Outputs	*Number*	2
		Type	Sourcing/Sinking
		Rating (Total for all outputs)	2 amps
Fixture Transmitter P/N 33-0120-30	**Batteries**		QTY:2 CR2 LITHIUM BATTERIES
	Frequency		900MHz
	Unique MCU Pairing Capacity		5
	Input		3 Pin M8

Figure 71: Guardian Specifications

Maintenance

The entire Guardian system is designed to be nearly maintenance free. There are two CR2 batteries in each FTU. Follow the instructions below to replace the batteries. Vektek does recommend that the face of the Master Control Unit be cleaned periodically with a mild cleaner (i.e. non-ammonia glass cleaner) to remove foreign matter from the screen. The Fixture Transmitter and Pallet ID Reader should be inspected occasionally to check for damage to the enclosures.

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Replacing the FTU Batteries

1. Remove the rear cover from the FTU.
2. Take out the old batteries and insert new batteries into the unit.
3. Reinstall the back cover being sure to inspect the o-ring for cracks and re-torquing the screws to 5 In-Lbs. of torque.

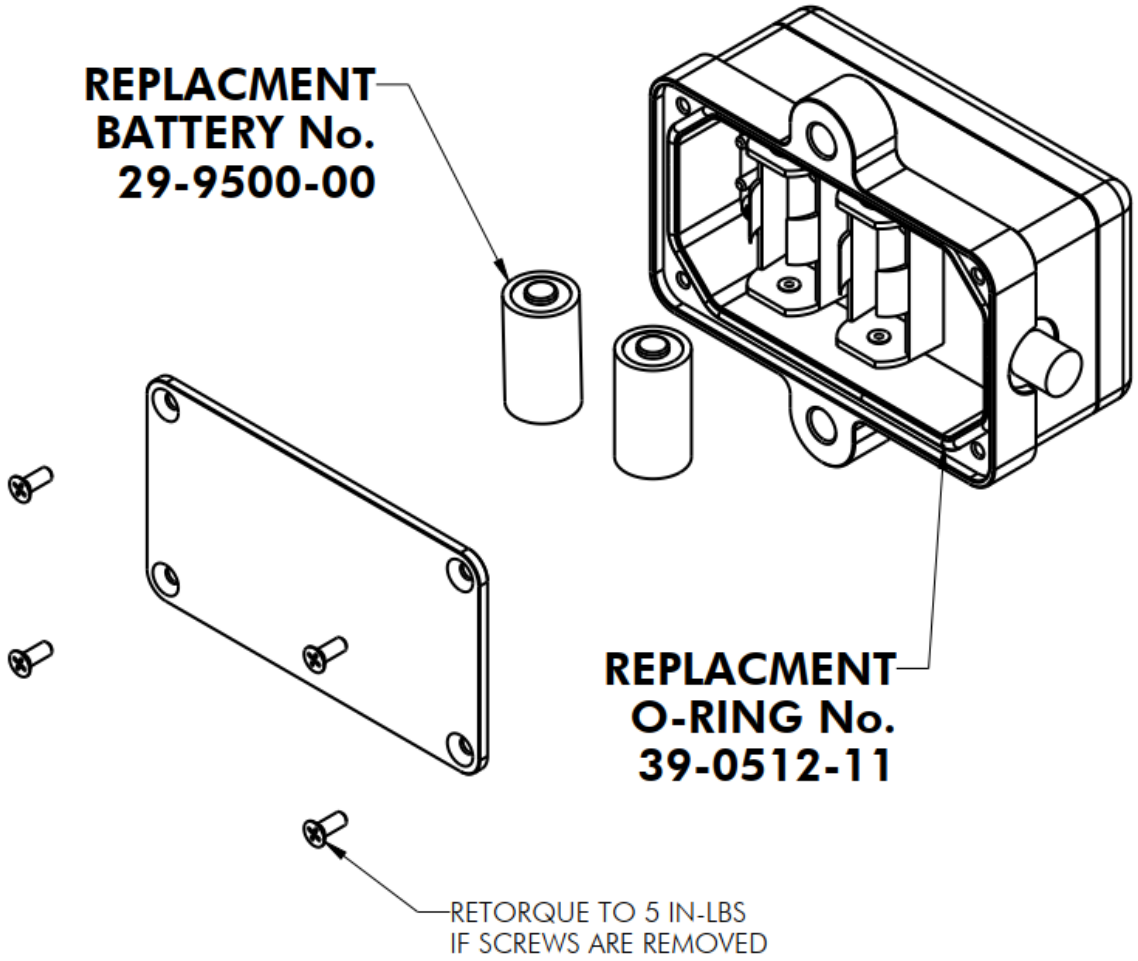


Figure 72: FTU PARTS BREAKDOWN

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Troubleshooting

Symptom	Cause	Solution
MCU does not power on.	1. No power 2. Bad Ground	1. Check ground connection 2. Check from Positive pin 2 to pin 1 Ground for +10-36VDC
MCU does not communicate with FIXTURE TRANSMITTER	1. Out of Range 2. FTU is covered in chips. 3. FTU is damaged 4. Discharged Batteries	1. Replace Batteries 2. Clear chips. 3. Replace FTU. 4. Reattach cable or replace cable. 5. Repair using add pallet menu
Machine always shows the alarm.	1. FTU reporting no pressure 2. Machine is not using correct logic to interpret Guardian output. 3. Logic of Guardian outputs not correct.	1. Use Pressure Switch Setter/Checker to determine if continuity is present (pressure switch contact is closed). 2. Invert Machine Logic 3. Check wiring. 4. Use Diagnostics menu to toggle Main Contact and check function of input to machine. 5. Verify that the Guardian relay output is set as expected to either Normally Closed or Normally Open. 6. Check connection of Relay Common. Connect Relay Common to the voltage for the proper signal, 24V for a 24V signal and 0V for a 0V signal.

Figure 73: TROUBLESHOOTING DIAGRAM

If the preceding chart does not correct the problem, please contact Vektek Customer Support at 1-800-992-0236 for additional assistance. Please have MCU version and ID number available for technical support.

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