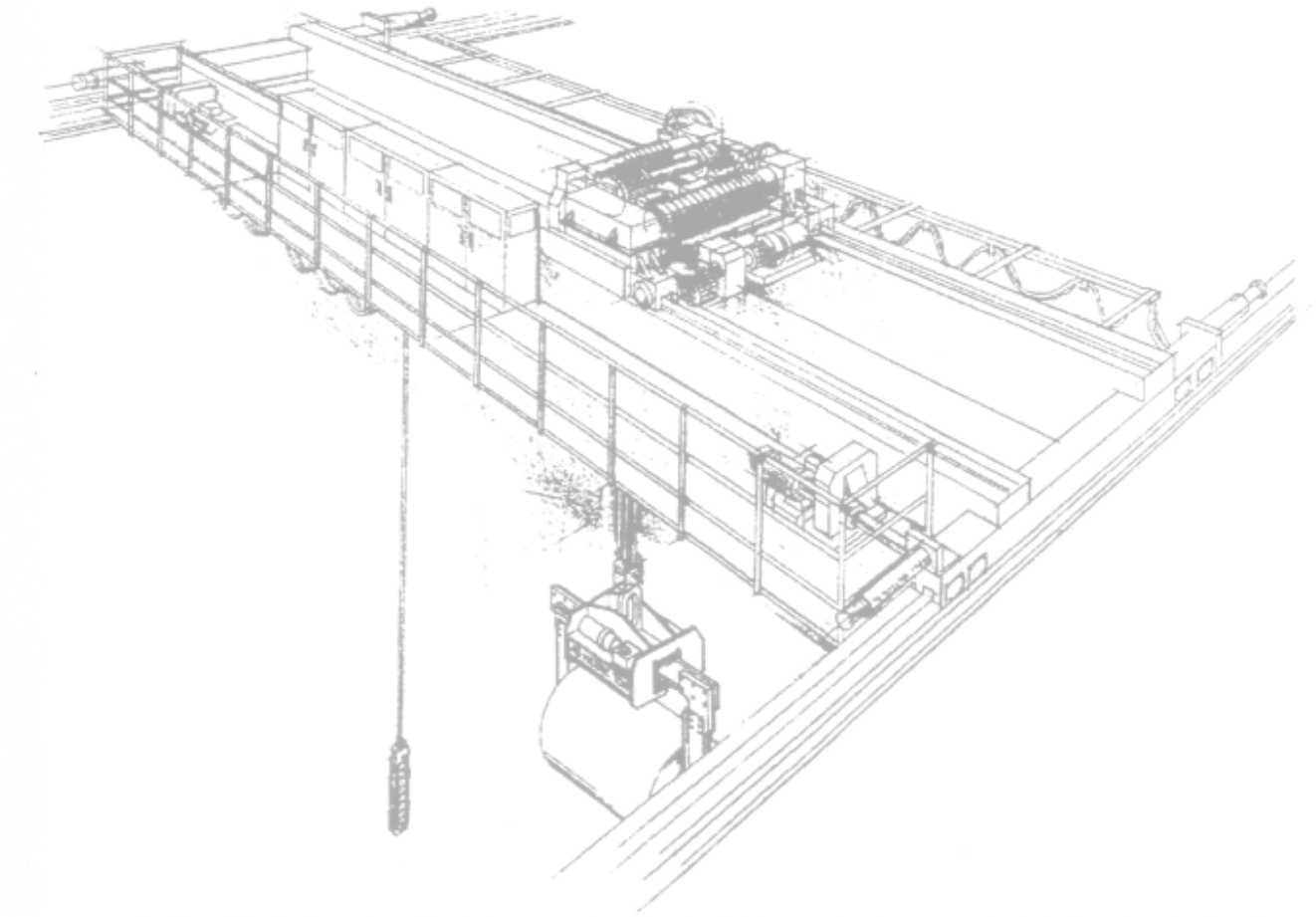

ReFlx 120/120 "Plus"

Collision Avoidance System

Instruction Manual

MAGNETEK
UNCOMMON POWER

Electromotive Systems

REFLX120P-02A April, 2002
Part Number: 005-1084

General Overview of the ReFlx 120 and 120 "PLUS" Collision Avoidance System

The ReFlx 120 and 120 "Plus" Collision Avoidance Systems are intended for use with overhead crane bridges and trolleys, and monorails, to prevent collisions or to limit the approach of adjacent bridges, trolleys, monorails or structures.

The Reflx 120 & 120 "Plus" Systems use infrared light sensors to detect the distance between two objects, such as the bridges of two overhead cranes or the bridge of an overhead crane and a fixed object or structure. When the sensor detects an object within the adjusted distance, a signal will be sent to the controller. Relays in the controller will activate and either open or close based on your application. For further detailed information, please see the Applications and Installation sections of this manual.

ReFlx 120 System

This is a single sensor system. It is most commonly used in applications requiring only a stop command. The two-channels in the sensor will be used as a primary stop and an emergency redundant stop.

System Includes:

(1) Two(2) Channel Sensor with 16ft control cable
(1) Controller
(1) Diamond Reflective Target - 2ft. x 2ft.

Figure 1.1 ReFlx 120 System

ReFlx 120 "Plus" System

This is a two sensor system. It is most commonly used in applications requiring "slow-down" or warning and a stop command. The two-channel sensor will be used as the "slow-down" or warning and a primary stop. The second sensor (single channel) is used as an emergency redundant stop.

System Includes:

(1) Two(2) Channel Sensor with 16ft. control cable
(1) Single Channel Sensor with 16ft. control cable
(1) Controller
(1) Diamond Reflective Target - 2ft. x 2ft

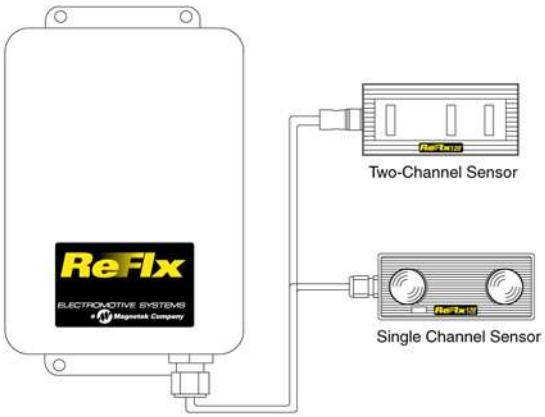

Figure 1.2 ReFlx 120 Plus System

The ReFlx 120 and 120 “Plus” Components

Controller:

The main component of the controller is a circuit board containing the power supply, rectifier and relays. There are four (4) form C relays mounted on the circuit board. Two (2) 12 amp relays are for channel 1 of the two (2) channel sensor, and two (2) 12 amp relays are for channel 2. The “Ch3 out” is a single (1) 10 amp, form C, output for the single channel sensor. The relay for the single channel sensor is located in the sensor and is wired to the control circuit board. The power transformer is capable of single phase 120VAC or 240VAC power. There are terminal blocks on the circuit card for main power, sensor power, and the relay outputs.

The standard controller consists of the circuit board, mounted in a NEMA 12 enclosure with cable grips for power, and the sensors.

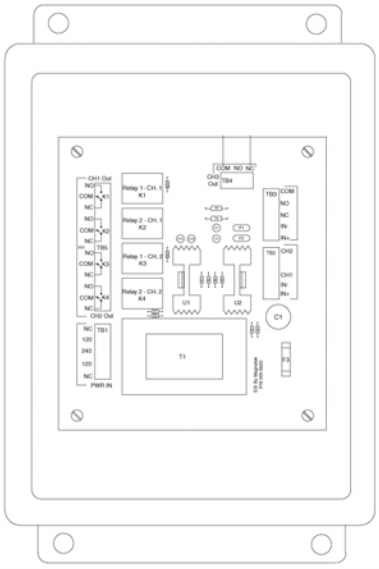

Figure 2.1 Controller Board and Enclosure

Two(2) - Channel Sensor:

This sensor has two (2) channels in a single compact housing. Each channel can be individually adjusted with a scanning range from 20ft. to 120 ft. This sensor is used with both the ReFlx 120 and 120 "Plus" Systems. When used in the ReFlx 120 System, the two (2) channels are used for a primary stop and a redundant stop. When used in the ReFlx 120 "Plus" System, the first channel is typically used to provide a “slow-down” command or warning signal, and the second channel is used to provide the primary stop to the motion control. In either system, this sensor is always used with the 2ft. x2ft. diamond grade reflective target.

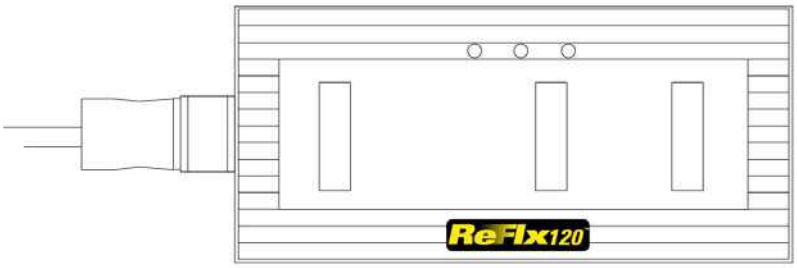

Figure 2.2 Two(2) Channel Sensor

The two (2) channel sensor is made up of a transmitter and two (2) receivers. The transmitter is an infrared LED light source that sends a pulsed light beam toward the reflective target. When this light beam hits the target, it is reflected back to the sensor's receivers. As the sensor (ie. bridge, trolley, etc.) moves toward the target, the receivers are monitoring the reflected signals. When the sensor moves within the determined distances from the target, the controller "trips" the corresponding relays.

There are three (3) LEDs on the face of the sensor. The green LED is "on" whenever power is applied to the sensor. The yellow LED is the channel 1 indicator and the red LED is the channel 2 indicator. As the sensor moves within the determined distances of the target, the respective LEDs will be "on." As the sensor moves away from the determined distances of the target, the respective LEDs will be "off."

The switching mode for this sensor is "dark switching," which means the controlling relay contacts close on power up and will open if there is a loss of power or the diamond grade target is detected.

NOTE: This sensor is intended for dry indoor use only. If outdoor use is required, please consult Electromotive Systems.

Single - Channel Sensor

This sensor has only one (1) channel and an adjustable scanning range is from 1.5ft. to 20 ft. The main function of this sensor is to provide a redundant stop in ReFlx 120 "Plus" Systems.

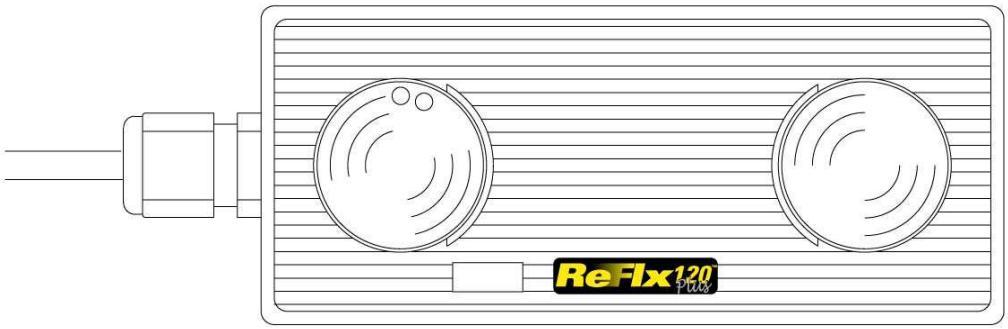

Figure 2.3 Single Channel Sensor

The single channel sensor is made up of a transmitter and a receiver. The transmitter is an infrared LED light source that sends a pulsed light beam toward another crane or object. When this light beam hits the other crane or object, it is reflected back to the sensor's receiver. As the sensor (ie. bridge, trolley, etc.) moves toward the other crane or object, the receiver is monitoring the reflected signals. When the sensor moves within the determined distances from the other crane or object, the form C relay inside the sensor "changes state."

There are two LEDs: one inside, and one at the top of the left "eye." The green LED is "on" whenever power is applied to the sensor. The yellow LED comes "on" whenever the sensor moves within the determined distance of another crane or object.

No target is used with this system. Instead, it uses the object to be detected as the target, regardless of the color and texture of the surface.

NOTE: This sensor is intended for dry indoor use only. If outdoor use is required, please consult Electromotive Systems.

ReFlx 120 and 120 “Plus” Application Guidelines

Contactor Control

Bridge and trolley motions, using reversing contactors for control, rely on the crane’s mechanical brakes for stopping. Therefore, the buffer zone (minimum distance to mating crane or obstruction) should be sized to allow for future brake wear.

Adjustable Frequency Crane Control

Because adjustable frequency drives (AFD) have various programmable stopping options, consideration should be given to these various means when setting up the ReFlx 120 “Plus” System.

Using the AFD Limit Switch Inputs

Most modern AFDs include programmable limit switch input terminals for each direction of travel (Upper Limit 1 and Upper Limit 2), with provision for automatic slow-down. As soon as the bridge reaches the sensing distance for Channel 2, the drive will command the crane to slow down using a separately programmable speed switch frequency and deceleration time. When the bridge reaches the sensing distance for Channel 1 or 3, the drive will “decelerate at stop command” or provide “immediate stop at stop command” (see definitions below), depending on how the drive is programmed. The input to the drive from Channel 3 can be run parallel to that of Channel 1, or run to a multi-function input terminal on the AFD.

Decelerate at “Stop Command”

Upon receiving a “Stop Command” from the ReFlx 120 “Plus” System, the output frequency of the AFD decreases to near zero at the programmed deceleration ramp; and the brake is commanded to set. See the table on page 15 for approximate stopping distances at various deceleration times. These stopping distances will be slightly longer when the AFD is programmed with an S-Curve ramp.

Immediate Stop at Stop Command

Upon receiving a “Stop Command” from the ReFlx 120 “Plus” System, the AFD base blocks the main output transistors, thereby electrically disconnecting the motor from the AFD, and through the brake interlock, commands the brake to set. In this mode, the crane functions similar to Contactor Control and relies on the crane’s mechanical brakes for stopping. Therefore, the buffer zone (minimum distance to mating crane or obstruction) should be sized to allow for future brake wear.

NOTE: It may be necessary to recalibrate the ReFlx 120 “Plus” System whenever the deceleration time is changed. Test all motions under worst case scenario before putting crane into operation.

Contact Electromotive Systems for applications involving other types of controls or options.

System Installation Guidelines

Sensors

The sensors transmit and receive an infrared light signal, thus measuring the distance to the target or structure. When mounting these sensors, no obstructions should be present in-between the sensor and the reflective target or structure.

The two(2) channel sensor should be mounted so that the center of the sensor is lined up, both vertically and horizontally, with the center of the 2ft x 2ft reflective target. The single channel sensor uses the structure it is to avoid as a target. This sensor should be mounted so it has at least a 2ft x 2ft area on the structure as a target. The center of the sensor should be lined up, both vertically and horizontally, with the center of the 2ft x 2ft area on the structure.

When two sensors are mounted, facing in the direction shown in Fig. 3.1 Crane Layout Drawing, they should be mounted so the distance from the center of one sensor is a minimum of 5 feet from the center of the other sensor. This minimum 5 foot distance applies whether the sensors are separated horizontally or vertically.

When two sensors are mounted, facing toward one another as shown in Fig. 3.1 Crane Layout Drawing, they should be mounted so the distance from the center of one sensor is a minimum of 6 feet from the center of the other sensor. This minimum 6 foot distance applies whether the sensors are separated horizontally or vertically.

Sensors should be mounted a minimum of 5 feet from walls, ceilings, I-beams, or other objects that could act as a target.

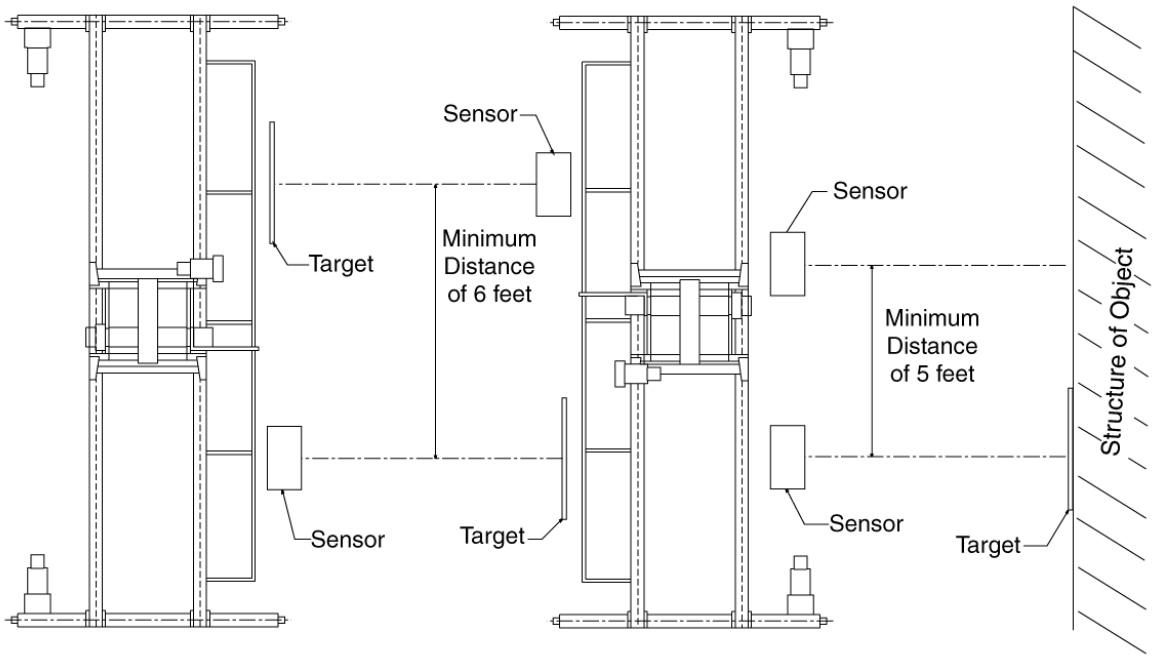

Figure 3.1 Crane Layout Drawing

Individual mounting brackets for the sensors are supplied with each system. The mounting bracket, as shown in Fig. 3.2 Single Channel Sensor with Mounting Bracket, allows for horizontal adjustment of the sensor. Once the sensor has been correctly aligned, secure all bolts to prevent any movement during operation.

Note: The same type of mounting bracket is used for both types of sensors

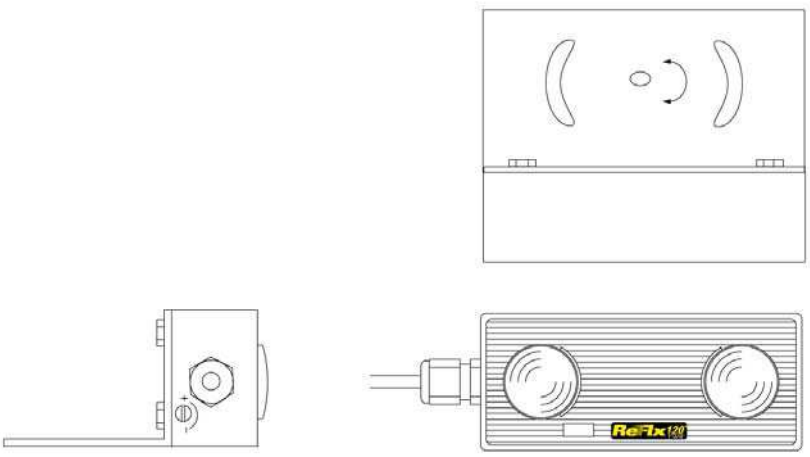

Figure 3.2 Single Channel Sensor with Mounting Bracket

Controller:

Securely mount the controller enclosure, using the four holes provided. See Fig.3.3 Enclosure Dimensions, for the enclosure mounting dimensions. The controller should be mounted in a dry location and as close to the crane controls as possible.

Note: The length of cable for each sensor is 16 feet. The controller should be mounted in a location that is within 16 feet of both sensors, preferably at the shortest distance possible.

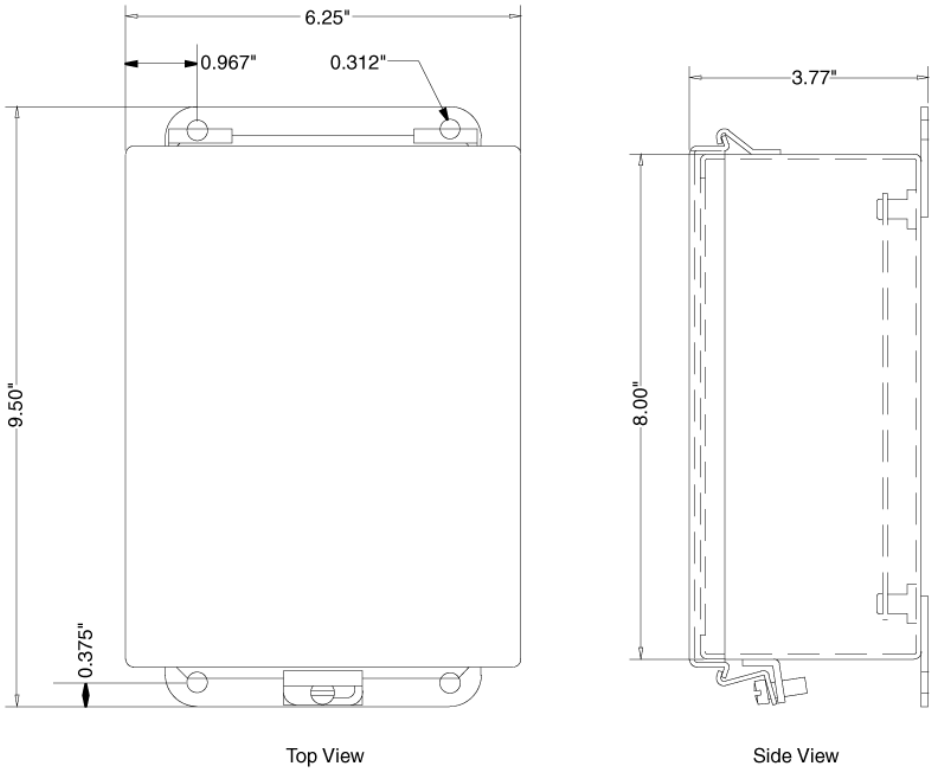

Figure 3.3 Enclosure Dimensional Drawing

Wiring and Set Up

Before wiring and setting up the system, the controller, sensor(s) and target should be securely mounted. See the "System Installation Guidelines" section on page 5.

Wiring Suggestions:

1. Wiring should be performed by qualified personnel only.
2. The National Electric Code and local electrical installation requirements and codes should be followed.
3. Do not connect or disconnect any wiring while power is applied to the controller.
4. Separate all power and control wiring. When necessary cross control wiring at 90 degree angles to the power wiring.
5. Make control wiring as short as possible.
6. Place surge-suppressors on all contactors and relays.

Wiring:

Reference Fig. 4.3 ReFlx 120 "Plus" Schematic Drawing on page 10 during the wiring process.

1. If conduit is required, install it at this time. The controller is supplied with cord grips for the input power and the sensor(s). Remove these cord grips and punch the holes required for the conduit. If conduit is required for the sensors, run it so that it ends approximately 6 inches from the sensor. Run the supplied sensor cable through the conduit.
2. Wire the input power to terminals H and N on the terminal block labeled "PWR IN". The input power can be either 120 or 240 VAC. Note the jumpers on the "PWR IN" terminal block. When using 120VAC power the jumpers must be between terminals 2&3 and 4&5. When using 240 VAC power the jumper(only 1) must be between terminals 3&4.

The input power wires should be fed through the 1/2" cable grip at the lower left-hand side of the controller.

WARNING: Wiring of the control board to the correct voltage is critical. Failure to do so could cause damage to the system.

3. Wire in the sensor(s) as shown in Fig. 4.3 ReFlx 120 "Plus" Schematic Drawing. If you have the ReFlx 120 System, you will only wire the "two (2) channel" sensor. If you have the ReFlx 120 "Plus" System, you will wire in both sensors.

   The sensors should be wired through the 3/8" cable grips located in the lower right-hand side of the controller enclosure.

Setup:

1. Adjust the set screws on the sensor(s) counter-clockwise. The two (2) channel sensor will have a set screw for each channel on the top of the sensor. On this sensor, turn each set screw counter-clockwise until you hear or feel a "click." See Fig. 4.1 Two(2) Channel Sensor on page 8.

   The single channel sensor will have a set screw on the side of the sensor by the cord connector. See Fig. 4.2 Single Channel Sensor on page 9. As you adjust the set screw, the indicator on the front of the sensor will move accordingly. Adjust the set screw counter-clockwise until the tab on the indicator is lined up with the 6, or until the adjustment becomes hard to turn.

With the set screws adjusted fully counter-clockwise, both sensors are adjusted for their respective maximum distances.

2. Move the crane so that it is approximately 130 ft. from the target or object.
3. Apply power to the circuit board. When power is applied, the four (4) relays on the control board will energize, changing the state of the contacts. The two LEDs, labeled CH1 and CH2 in the center of the board, will also be “on.” On the two (2) channel sensor, the green LED will be “on” and the red and yellow LEDs will be “off.” On the single channel sensor, the green LED will be “on” and the yellow LED will be “off.” If the LEDs are not in this state, move the crane further away from the target. Otherwise see the troubleshooting section of the manual.
4. Move the crane toward the target/structure to a distance where you would like the first channel of the two (2) channel sensor to trip. Remember this distance must be between 20 and 120 feet. Once the crane is at the required distance, adjust the Channel 2 set screw clockwise until the red LED on the face of the sensor is “on.” At this point the red LED, labeled CH2 in the center of the control board, will be “off” and relays K3 and K4 will be de-energized.
5. Continue to move the crane toward the target/structure to a distance where you would like the second channel of the two(2) channel sensor to trip. Remember this distance must be between 20 and 120 feet. Once the crane is at the required distance, adjust the Channel 1 set screw clockwise until the yellow LED on the face of the sensor is “on.” At this point the red LED, labeled CH1 in the center of the control board, will be “off” and relays K1 and K2 will be de-energized.

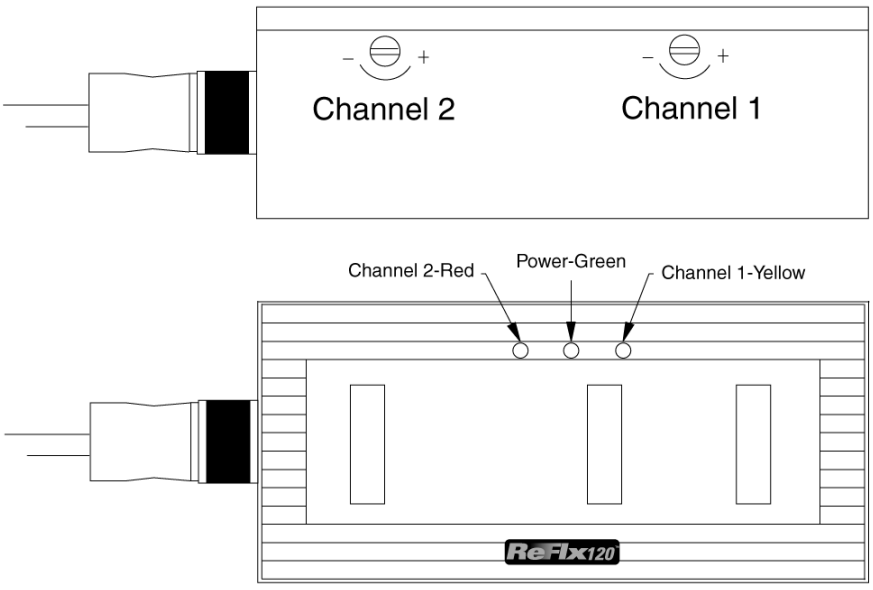

Figure 4.1 Two(2) Channel Sensor

6. Having both channels set, move the crane away from the target/structure until it is out of the sensing range. Now bring the crane toward the target/structure to verify the distances set are accurate for the application. If they need to be adjusted, follow steps 4 through 6 until the channels are properly adjusted.

   NOTE: If you have a ReFlx 120 System, proceed to step number 9. If you have a ReFlx 120 "Plus" System, proceed to step 7 for the single channel sensor adjustment.

7. Once again continue to move the crane toward the structure to a distance where you would like the channel of the single channel sensor to trip. Remember this distance must be between 1.5 and 20 feet. Once the crane is at the required distance, adjust the set screw on the side of the sensor clockwise, until the yellow LED located in the left sensor “eye” is on.

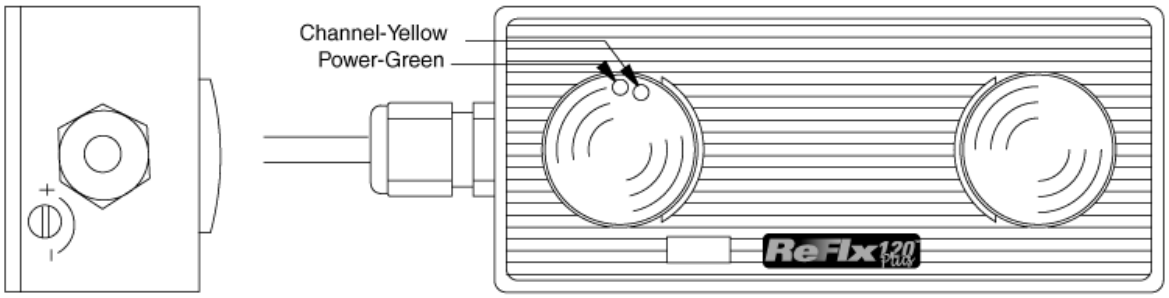

Figure 4.2 Single Channel Sensor

8. Move the crane away from the structure until it is out of the sensing distance. Now bring the crane toward the structure to verify the distance set is accurate for the application. If it needs to be adjusted, follow step 7 until the channel is properly adjusted.
9. At this point all of the channels on the sensor(s) should be properly adjusted. Connect the output wiring from the existing controls to the relays on the control board. Operate the crane as it would be in typical day to day use. If any of the distances need to be adjusted, go back to steps 4 through 8 and adjust the sensor(s) accordingly.

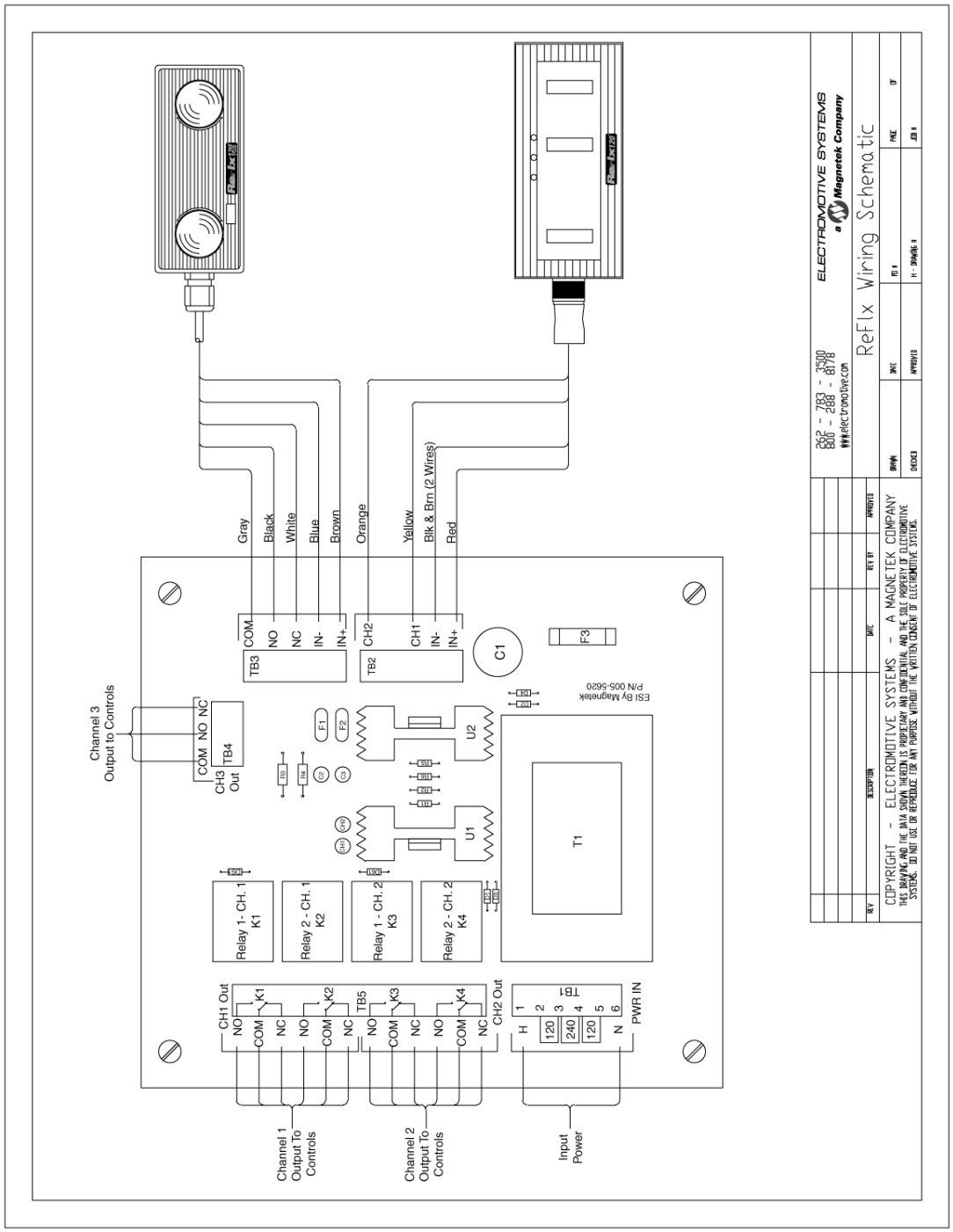

Figure 4.3 Schematic Drawing for the ReFlx 120 Plus System

Troubleshooting

Introduction

This chapter covers what to do if the ReFlx System does not seem to work properly. If you are unable to resolve the problem after using this section, contact Electromotive Systems immediately at 1-800-288-8178.

WARNING

- Only authorized personnel are permitted to perform the initial setup or service work. Use only Electromotive Systems parts.
- Do NOT touch any circuit components on the circuit board while the main AC or DC power is on.

Common Problems

The following are possible problems associated with using the ReFlx Systems, and their possible solutions. For help in diagnosing problems with the controller, refer to the drawings in the Wiring and Set-up section that shows the location of the diagnostic LEDs for the control board and sensors.

Problem: Power (120/240VAC) is applied to the control board, but the channel LEDs in the center of the board are not on.

Possible Solution(s):

- The jumpers required on the “PWR IN” terminal block are either not connected to the terminal block or are not tightened down.
- The power Leads (IN+ or IN-) for the two (2) channel sensor are not connected to the RFX100-2 terminal block or are not tightened down.
- The sensor channel leads(CH1 or CH2) for the two(2) channel sensor are broken, not connected to the RFX100-2 terminal block, or are not tightened down.
- The fuse F3 is blown and needs to be replaced.
- The fuse F1 is blown and needs to be replaced.

Problem: Power (120/240VAC) is applied to the control board, but only one of the channel LEDs in the center of the board is “on.”

Possible Solution(s):

- One of the sensor channel leads(CH1 or CH2) for the two(2) channel sensor are not connected to the RFX100-2 terminal block or are not tightened down.
- One of the sensor channel leads(CH1 or CH2) for the two(2) channel sensor is broken in the cable.

Problem: Power (120/240VAC) is applied to the control board but the green power LED on the single channel sensor is not "on."

Possible Solution(s):

- The jumpers required on the "PWR IN" terminal block are either not connected to the terminal block or are not tightened down.
- The power leads(IN+ or IN-) for the single channel sensor are not connected to the RFX100-1 terminal block or are not tightened down.
- The fuse F3 is blown and needs to be replaced.
- The fuse F2 is blown and needs to be replaced.

Problem: The green power LED on the sensor is "on" and the channel LEDs are changing state, but the relay outputs are not changing.

Possible Solution(s):

- Check all of the wiring connections on terminal blocks RFX100-1 and RFX100-2.
- Check for any broken sensor wires.
- Contact Electromotive Systems.

Problem: I continue to adjust the set-screw on the two(2) channel sensor and LEDs never change state.

Possible Solution(s):

- Adjust the set-screw counter-clockwise until you feel or hear a click. If you adjust the screw twenty full turns and the click does not occur, contact Electromotive Systems.
- Adjust the set-screw counter-clockwise until you feel or hear a click. Then try adjusting the set-screw clockwise again. If after ten full turns of the screw, the channels still do not change state, contact Electromotive Systems.

Problem: I continue to adjust the set-screw on the single channel sensor and LED never change state.

Possible Solution(s):

- Adjust the set-screw counter-clockwise until you feel the screw become hard to turn. Then again try adjusting the set-screw clockwise again. If after twenty full turns of the screw, or if you feel or hear a click, and the channel still does not change state, contact Electromotive Systems.

Component Specifications

Controller Board

Technical Data

Supply Voltage	120VAC or 240VAC
Power Fuse	F3 - 0.25A SLO-BLO Fuse
Control Fuses	F1, F2 - 0.4A PTC overcurrent Fuse
Output type	Four(4) Form-C Relays
Output Characteristics	12Amp @ 120VAC or 240VAC
Output Indicators	Two(2) Red LEDs indicating channel 1 and channel 2 functions
Type Connection	Terminal Blocks
Operating Temperature	-20°C to 60°C
Board Dimensions	6-27/32" H x 4-27/32" W - Panel Space
Enclosure Dimensions	8" H x 6" W x 4" D (NEMA 12)
Weight	22.2 oz.

Two(2) Channel Sensor

Technical Data

Scanning Range	20 -120 feet with reflective target
Light Type	Modulated infrared
Transmitter	IRED
Receiver	Photo-diode
Minimum Input Pulse Duration	30ms
Switching Frequency	10/s
Supply Voltage	15-48 VDC
Current Consumption	100mA max., no load
Output	0.2A, 1 PNP Transistor per Channel
Switching Mode	Dark switching
Output Indicators	Red LED indicates function of channel 2 Yellow LED indicates function of channel 1
Supply Voltage Indicator	Green LED, on when supply voltage is applied
Housing	Makrolon, black ribbed
Protection Category	IP 60 (Protection from dust, no protection from liquids)
Optical Surface	Glass Plate
Type Connection	16 foot cable with crimped leads
Operating Temperature	-20°C to 60°C
Weight	20.2 oz.

Single Channel Sensor

Scanning Range	1.5-20 foot on structure with a reflection value >6%
Light Type	Modulated infrared
Transmitter	IRED
Receiver	Photo-diode
Response/drop out time	100ms
Supply voltage	12-24 VAC/11-48VDC
Current consumption	100mA(no load)
Switching output	Voltage free relay contacts
Switching voltage	Maximum 240 VAC/DC
Switching current	Maximum 2 A
Output Indicator	Yellow LED for channel function
Supply Voltage Indicator	Green LED
Switching mode	Light or dark
Operating mode	Background suppression
Timing functions	Pull in or drop out time delay
Type connection	16 foot cable with crimped leads
Housing material	Macrolon, fiberglass reinforced plastic
Protection category	IP65 (NEMA 12, 13)
Operating temperature	-20°C to 60°C
Weight	13.5 oz.