

FORMULA SYSTEMS

FCU⁴⁷ SAFESCREEN

INSTALLATION MANUAL

**For
elevator
safety
edges,
always
specify**

FCU⁴⁷ SAFESCREEN

- Comprehensive Range
- Field-friendly Installation
- Fail-safe Operation



Contents

	Page
1. Introduction	2
2. How it works - FCU ⁴⁷	3
3. Controller-less connection	4
3.1 Power requirement	5
3.2 Earth / ground conditions	5
3.3 Signal output	5
3.4 Connection to existing Formula Systems control boxes	5
4. Universal Interface	6
4.1 Operation	6
4.2 Overload protection	6
4.3 Indicator LEDs	6
4.4 Options	6
5. Installation - FCU ⁴⁷	7
5.1 Installation	7
5.2 Mounting the edges	7
5.3 Cord routing	7
5.4 Switch selection	8
5.5 Indicator LEDs	8
6. Installation - Universal interface	9
6.1 Installation - FPS 0270 and FPS 0271	9
6.2 Additional features - FPS 0271	9
6.3 Time out relay option - FPS 0271	9
6.4 Detect relay option - FPS 0271	10
7. Packing list	11
7.1 Product identification	11
7.2 Standard system with universal interface	11
7.3 Long range system with universal interface	11
7.4 Standard system for controller-less connections	11
7.5 Long range system for controller-less connections	11
8. Product specification	12
8.1 FCU ⁴⁷	12
8.2 Universal Interface	14
9. Trouble-shooting guide	15
9.1 Problem checklist	15
10. Accessories	17
11. Contact Details	18

1. Introduction

Thank you for purchasing a Formula Systems elevator door protection product.

If you are familiar with our products and have used them in the past, you will be aware of the high levels of quality and service we provide as one of the largest global manufacturers of elevator door protection devices. The latest product range offers significant improvements. They have been designed to simplify installation and increase reliability in the harshest of environments.

If you have not used our products before, 'WELCOME!' We are confident that you will enjoy the benefit of our many years experience gained in elevator markets across the globe. Our products are intended to be simple, fit for purpose and to fully satisfy the requirements of you, your customers and their elevator passengers.

Formula Systems products are available in a variety of configurations suitable for both new and existing installations. In addition to our current range, we will happily work with you to create a solution that is custom-made to your requirements.

No-one understands elevator door protection systems better than Formula Systems. Having established a reputation for innovative design, technical excellence and unsurpassed reliability, our position as a market leader remains unchallenged.

All Formula Systems products are backed by the degree of service associated with a world leader, supported by a world wide network of agents offering a full after-sales service.

If you would like to know more about the best known name in elevator products talk to us at Formula Systems now.

IMPORTANT NOTICE

When the Formula Systems FCU⁴⁷ is used as a replacement for mechanical safety edges, it is the responsibility of the installer to ensure that on completion, the installation complies and conforms with all the relevant state codes, local codes and regulations that apply to infra-red and photoelectric door protection devices.

2. How it works - FCU⁴⁷

The FCU⁴⁷ is an infrared light curtain sensor system for detecting obstructions between elevator doors.

The system contains 47 protective beams spaced evenly as shown on page 13.

The standard product is suitable for door heights between 6'6" (1981mm) and 7' (2136mm).

The system consists of two parts - a Transmitter (Tx), and Receiver (Rx) edge. These edges contain all the intelligence required to control and synchronize the transmission and reception of all the protection beams and provide an output that indicates the obstruction status of the detector system.

The system has been designed to integrate efficiently into modern elevator systems.

In certain circumstances it can be connected directly to either the door operator or to the elevator control, in a similar fashion to that of a through beam photo-eye.

The electrical interface required to connect the system in this way is detailed in the section - **Controller-less connection** (page 4).

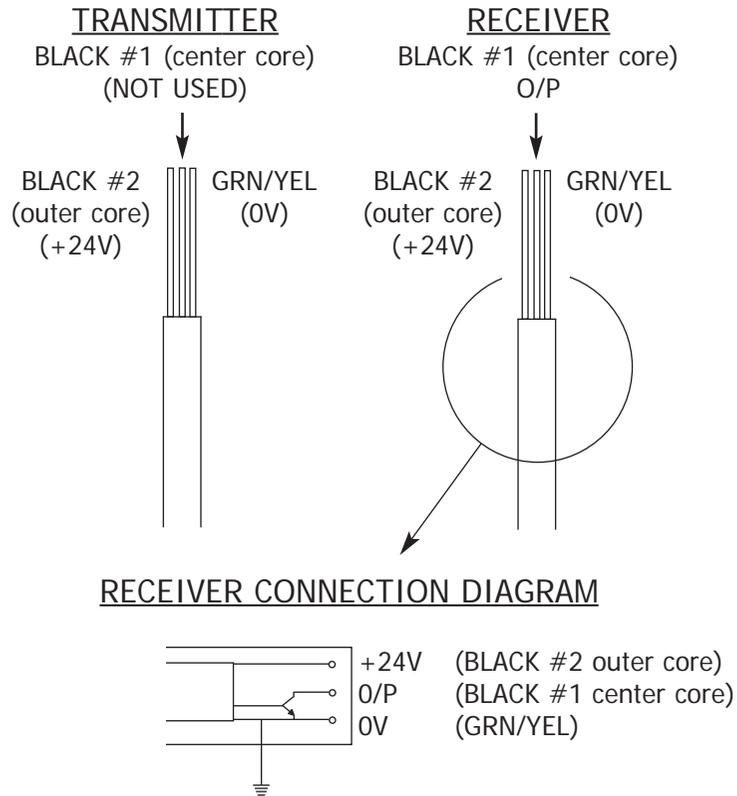
In certain circumstances, especially when modernizing existing elevators, controller-less connection may not be possible. In this instance an optional universal interface is available, allowing connection to all elevators. The universal interface is powered by mains voltage and provides connection to the elevator control via a dual pole relay with both normally open and normally closed contacts.

This universal method of connection is detailed in the section - **Universal interface** (page 6).

3. Controller-less Connection

The FCU⁴⁷ is designed to be connected from the door operator or controller auxiliary 24V DC supply, usually provided to power single photo eyes. The supply should be class II or protected against overload.

The output is an NPN open collector and is intended to be directly connectable to the door operator or controller. The local 24V supply must be able to have the negative pole connected directly to the car chassis.



Cross Reference (earlier version products):

BLACK #1 (center core)	= BROWN	= O/P
BLACK #2 (outer core)	= BLUE	= +24V
GRN/YEL	= GRN/YEL	= 0V

3.1 Power requirement

The edges require a 15V to 30V DC supply, capable of providing the required current - 100mA (Class II supply).

3.2 Earth / ground conditions

The 0V used by the FCU⁴⁷ is connected by default via the housing to ground (see diagram opposite). These connection conditions should be compatible with the 24V DC supply available.

3.3 Signal output

The output from the edge is an open collector NPN transistor. It has two states: during unobstructed operation, it will switch the output signal line to ground; when obstructed, the line will be released and allowed to float.

The output transistor is rated at 50V 50mA. It is usual for this line to be connected to a logic input with a pull-up on the door operator, but can be connected to the coil of a relay if a free contact is required. In this instance, a fly-back diode will be required across the relay coil to clamp the inductive energy released when the relay is de-energised.

If in doubt, do not connect the FCU⁴⁷ but seek further clarification. Refer to section - **Contact details**.

3.4 Connection to existing Formula Systems control boxes

All early versions of Formula Systems FPS control boxes provide a suitable dc supply for controller-less edges from their '+' (24V), and 'C' terminals.

These units also have a test link terminal which can be used directly by the open collector output from the controller-less edges to provide a universal interface to all elevator systems.

4. Universal Interface

4.1 Operation

The universal interface is designed to allow the latest generations of light curtains to be interfaced with any elevator control system. The interface can be powered by either 115V or 230V AC depending on the position of the voltage selection switch.

Two sets of change-over relay contacts are provided to connect the output of the interface unit to the elevator control.

To provide a fail safe response to power failure, the relay is normally in the energized state, and will drop out when any of the light beams are interrupted.

The 'N/O' (normally open), and 'N/C' (normally closed) terminal markings on the printed circuit indicate the contact state when energized.

4.2 Overload protection

The output of the universal interface is protected against short circuits by a Polyswitch current sensor. This will isolate the output under fault conditions.

NOTE: Once tripped the system can be reset by switching the AC supply off for approximately ten seconds.

4.3 Indicator LEDs

The green LED indicates that power is present.

The red LED illuminates when the system has identified an obstruction and the relay has dropped out.

4.4 Options

The universal interface is available in two forms, FPS 0270 basic unit and FPS 0271 equipped with the addition of a buzzer and timeout/nudging features

5. Installation - FCU⁴⁷

5.1 Installation

All versions of the FCU⁴⁷ can be mounted to the elevator in the same way. For centre opening applications, both units should be mounted on the landing side of the leading edge of the car door.

For side-opening applications, one of the edges will be mounted on the door (as with centre opening), the other fixed to the strike jamb opposite.

5.2 Mounting the edges

- Remove existing door protection or site guard.
- For centre-opening applications, attach angle brackets to the edges using the bolts provided.
- For side-opening applications, attach one bracket to the edge intended for the car door.
- Remove the filter cover from the edge to be mounted to the strike jamb to allow access to the mounting holes.
- To ensure adequate running clearance between the bottom of the edge(s) and the door track, positioning spacers are included in the parts kit.
- Stand the edge(s) on top of the spacer(s), their back(s) against the door(s) and/or slam, parallel to and a minimum of 1/8" (3mm) back from the leading edge of the door(s).
- Use the holes as a template to mark the location of the five (5) mounting hole positions.
- Centre punch and drill the holes marked and secure the edges into place using five (5) M4 x 20mm thread forming screws provided.

5.3 Cord routing

It is important that the cord is routed with sufficient free cord to avoid sharp bends or flexing. Ensure there is no risk of catching or rubbing by restraining the cord (using the nylon clamps and restraints provided in the parts kit). Generous bend radii should be maintained in the hanging loop, to avoid damage to the cord as it bends during operation.

5. Installation - FCU⁴⁷ (cont.)

5.4 Switch selection

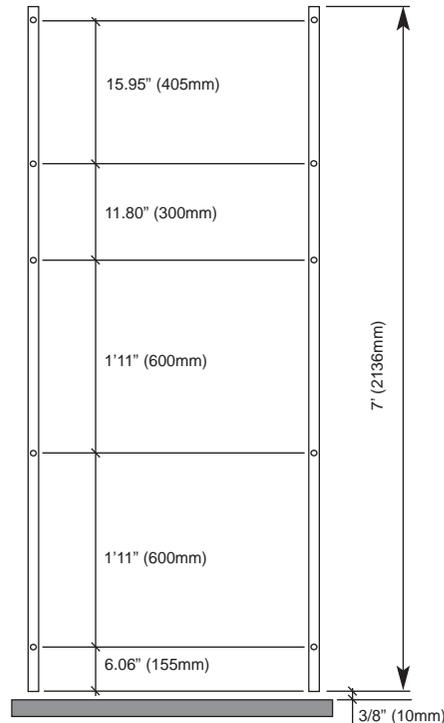
A selection switch is provided to control software options. Switch configuration is as follows:

Position 1(ON) = Enables single blocked sensor override
 Position 2 = Reserved

5.5 Indicator LEDs

Both the transmitter and receiver have a green LED to indicate that power is present.

In addition, the receiver (Rx) edge has a red LED to indicate that not all 47 beams are recognized as being present, or a beam is blocked due to an obstruction.



Mounting Hole Positions

6. Installation - Universal Interface

6.1 Installation - FPS 0270 and FPS 0271

The universal interface box can be mounted to the elevator car by means of the external mounting holes and screws.

Connect the electrical supply and relay output contacts to the elevator system according to local code requirements.

NOTE: Ensure the correct supply voltage is selected (115V or 230V), BEFORE switching on the supply.

Switch on the supply, check that both the red and green LEDs are on.

Connect the transmitter (Tx) and receiver (Rx) edges to either of the light curtain outputs provided on the universal interface.

With the light curtain uninterrupted the red LED should be off and the relay should be energized.

With the beams interrupted the red LED should illuminate and the relay drop out.

6.2 Additional Features - FPS 0271

Buzzer

The buzzer can be controlled in one of two ways:

Switch 1 'on', the buzzer will sound after a delay set by the system time out.

Switch 2 'on', the buzzer will sound immediately the system detects an obstruction.

If switch 1 & 2 are 'on' at the same time, switch 2 will override switch 1

6.3 Time out Relay Option - FPS 0271

The time out relay will change state after an obstruction has been present longer than the time out period set. The time out period can be

6. Installation - Universal Interface (cont.)

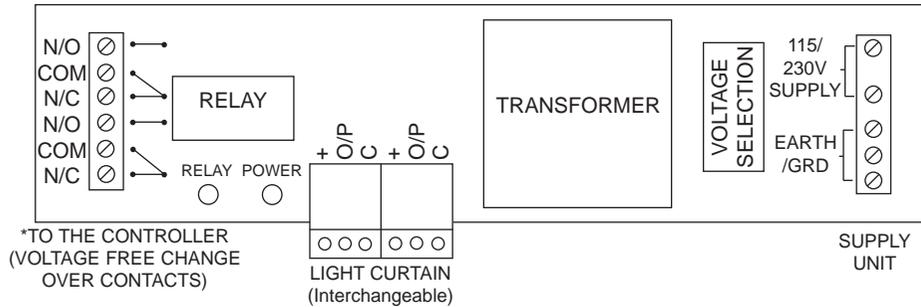
adjusted (by potentiometer on the PCB) between approx. 10 and 45 seconds, clockwise adjustment increases the time out. The potentiometer is marked 'time out', although possible to adjust by hand, it is recommended that a suitable screwdriver be used.

6.4 Detect Relay Option - FPS 0271 (Switch 3)

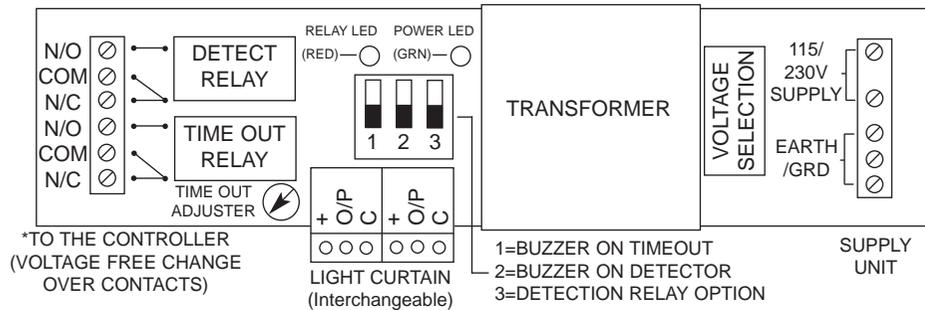
The detection relay can be configured to function in two ways:

- 'OFF': Detection relay remains in detection after time out and resets on obstruction removal.
- 'ON': Detection relay returns to non-detect during time out period and resets after delay on obstruction removal.

FPS 0270 UNIT



FPS 0271 UNIT



*Controller Relay: state shown when system is energised, operational and with no obstruction. NOT IN THE UN-ENERGISED RELAY STATE.

7. Packing List

7.1 Product identification

Ensure there is no shipping damage.

Please verify that you have received the correct product(s) specific to your application from the list below:

7.2 Standard system with universal interface:

FDS 0547**01 SAFESCREEN STD + UI 270

FCU 0547RX	- SAFESCREEN RECEIVER	- 1 off
FCU 0547TX	- SAFESCREEN TRANSMITTER	- 1 off
FPS 0270	- INTERFACE CONTROL UNIT	- 1 off
	- INSTALLATION KIT*	- 1 off

7.3 Long range system with universal interface:

FDS 0547**02 SAFESCREEN L/R + UI 270

FCU 0547RXLR	- SAFESCREEN RECEIVER L/R	- 1 off
FCU 0547TXLR	- SAFESCREEN TRANSMITTER L/R	- 1 off
FPS 0270	- INTERFACE CONTROL UNIT	- 1 off
	- INSTALLATION KIT*	- 1 off

7.4 Standard system for controller-less connections:

FCU 0547**01 SAFESCREEN COL STD

FCU 0547RX	- SAFESCREEN RECEIVER	- 1 off
FCU 0547TX	- SAFESCREEN TRANSMITTER	- 1 off
	- INSTALLATION KIT*	- 1 off

7.5 Long range system for controller-less connections:

FCU 0547**02 SAFESCREEN COL L/R

FCU 0547RXLR	- SAFESCREEN RECEIVER L/R	- 1 off
FCU 0547TXLR	- SAFESCREEN TRANSMITTER L/R	- 1 off
	- INSTALLATION KIT*	- 1 off

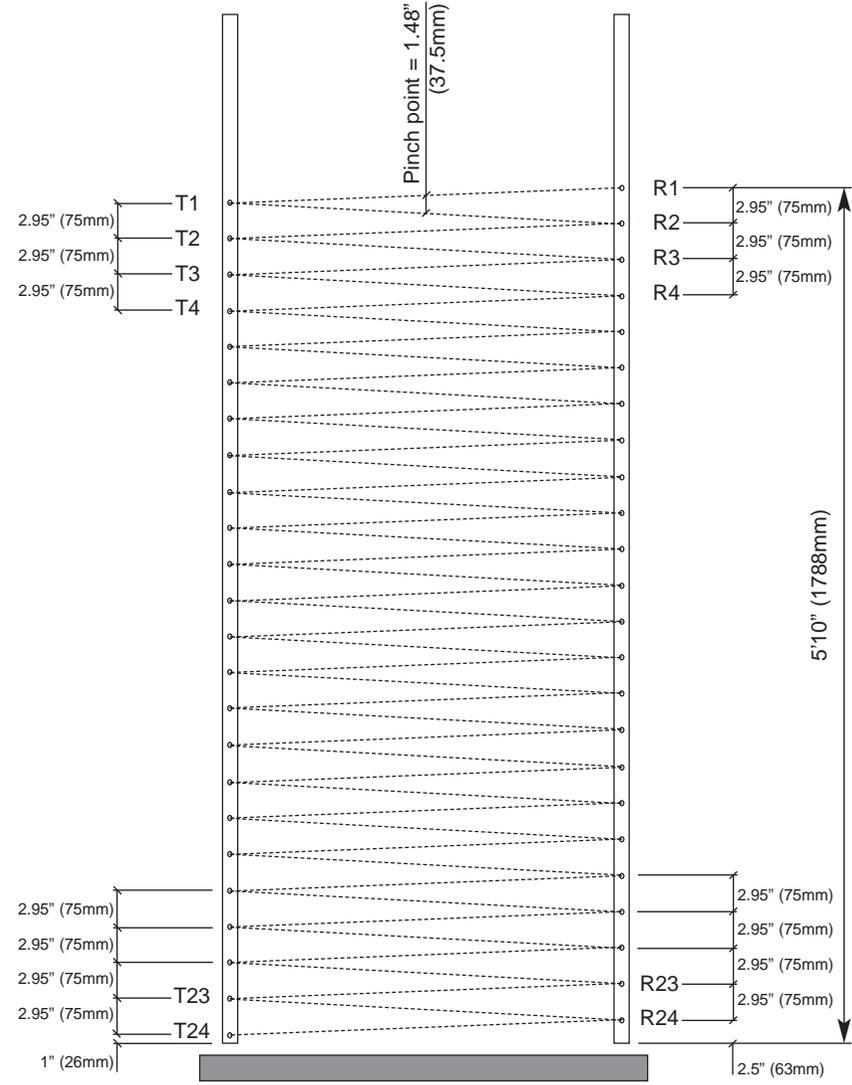
* For the contents of the installation kit, refer to section 8.1.

** Customer specific.

8. Product Specification

8.1 ECU⁴⁷

Item	Detail	Additional comments
Number of Beams	47 non-focused beams	Infra-red
Number of Sensors	24	See beam drawing
Sensor Spacing	2.95" (75mm)	See beam drawing
Distance between beams at pinch point (doors closed)	1.48" (37.5mm)	See beam drawing
Scan Type	Interleaved	
Response Time	10 to 100 milliseconds	Relates to point of detection in scan cycle
Range of detection	6' Door mounted (1800mm) 16' Door mounted (5000mm)	Standard product Long range product
Light Immunity	50 000 lux	Visible light
Angular Displacement	10°	
Position Mounting Tolerance	+/- 0.7" (18mm) vertically +/- 0.2" (5mm) side by side	Doors closed, units touching
Operating Voltage	24 volts	16 volts min 30 volts max
Current Consumption	<100 mA RMS	Total of both units
Control Unit	Not required	Optional Interface (FPS 0270 or FPS 0271)
Environmental Protection		Conformal coating to PCB's
Operating Temp. Range	0°C to +70°C	
Storage Temperature Range	-40°C to +80°C	
Unit Size	1.18"x0.8"x7" (30x20x2136mm)	
Mounting	Five screw positions	See mounting drawing
Indicators	Supply present: System fault/beam obstructed:	Green LED Red LED
Cable Supplied	Two x 13' (4m) approx of 3 core cable	Connects to product via short fixed lead
Case Material	Aluminium alloy	Finished Black
Cover (filter)	Infra-red transparent plastic	Snap-on fixing
Installation Kit	Instructions - 1 off Spacer Block - 1 off Cable Clips - 6 off Nytie - 8 off Screws M4.0 x 20mm -24 off Washers -24 off Shk. Prf. Washers M4.0 -24 off Mounting Brackets - 2 off Screws M5.0 x 10mm -10 off Washers M5.0 -10 off Shk. Prf. Washers M5.0 -10 off Self adhesive pads - 4 off Cable retainer - 2 off Screwdriver - 1 off Drill Bit - 1 off	Various Thread forming Large diameter Use with Mounting Bracket Use with Mounting Bracket Use with Mounting Bracket Optional Optional Optional Optional
System Approvals	UL, cUL, CE (EMC)	EN12015, EN12016

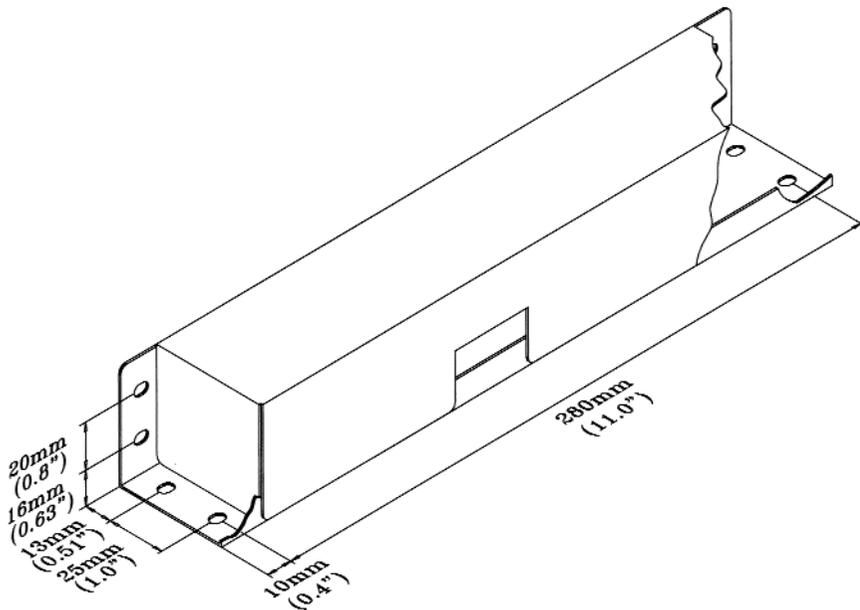


Beam Pattern

8. Product Specification (cont.)

8.2 Universal Interface

Item	Detail	Additional comments
Supply Voltage	230 or 115V AC (50Hz or 60Hz)	Switch selected (SW1)
Signal Output	Volt free change-over relay contacts	Contacts rated / set, 240V AC 4A RES.
Fail Safe Conditions	Faulty cable or Supply Failure	
Compatibility	FCU 0500 & 0700 Series, FZU 1000 Series	
Enclosure	Coated Steel	
Operating Temp. Range	0°C to +70°C	
Storage Temperature Range	-40°C to +80°C	
Unit size	2"x2"x12" (54x54x300mm)	Nominal Dimensions
Mounting	Four screw positions	See drawing below
Indicators	Supply present: System fault/beams obstructed:	Green LED Red LED
System Approvals	UL, cUL, CE (EMC)	EN12015, EN12016
FPS 0270 specific:		
Power consumption	3.5VA (Typical)	
FPS 0271 specific:		
Power consumption	4.0VA (Typical)	
Function Switch (SW2):		
Position 1	Buzzer on time-out	Enabled when sw to 'ON'
Position 2	Buzzer on detection	Enabled when sw to 'ON'
Position 3	Detection relay options	See section 6.4



9. Trouble Shooting

9.1 Problem Check List

The check list will help to identify most of the problems and their causes.

	DOORS WILL NOT CLOSE	DOORS START TO CLOSE BUT IMMEDIATELY RE-OPEN	DOORS START TO CLOSE BUT OPEN IN MID TRAVEL	DOORS START TO CLOSE BUT OPEN 6" FROM CLOSED	DOORS CONTACT OBSTRUCTION BEFORE RE-CLOSING	DOORS CONTACT OBSTRUCTION WITHOUT RE-OPENING
DETECTOR WIRES CROSSED	•					
WRONG MAINS CONNECTIONS IN P.S.U.	•					•
LOW VOLTAGE TO DETECTOR	•					
DOOR STOPPING DISTANCE TOO LONG						•
DUST ON FILTER	•					
LOOSE DETECTOR CONNECTIONS	•	•	•	•	•	
INTERMITTENT CABLE SHORT OR BREAK	•	•	•	•	•	
ELECTRICAL NOISE IN LINE	•	•	•	•	•	
GROUND PROBLEM		•	•	•		•
WRONG DETECTOR INSTALLED	•		•	•		
ELECTRICAL SHORT IN DETECTOR CABLE	•					•
INCORRECT WIRING TO CONTROLLER	•					•

If the above table does not resolve your installation issues, follow the steps below to check each part of the system and the interface to the elevator control:

- Check that power is present on both Rx and Tx edges. A small green LED at the top of each edge indicates power is present.
- Confirm the voltage between the positive and common supply input (nominally 24V) is between 16 and 30 volts DC.
- If the universal interface is being used, confirm the mains voltage selection switch is set for the voltage being used.
- Confirm that the red LED is normally 'off' but will come on when any beam is obstructed. The Rx edge has a red LED next to the green LED which is normally off, but which will illuminate under any of the following conditions:

9. Trouble Shooting (cont.)

- Any one of the beams are blocked.
 - The system is outside of its range/angular specification
 - The lens is dusty or dirty.
 - Either the Rx or Tx edge is damaged or faulty.
-
- The signal output will be 'High' in the beam-blocked state (red LED on) and 'Low' to indicate no obstruction (red LED off). When high the signal voltage will normally be 'pulled up' to the same voltage as the low voltage DC supply, but because of the nature of the open collector output, may be any voltage that represents the logic high state of the logic circuits within the elevator control system.

Ground is used as the reference voltage for 'logic low', and the signal output should be no more than 0.6 volts higher than ground in the logic low state, if it is ensure the load it is switching is not higher than 50mA.

Determine that the signal output toggles between these two voltages when the beams are interrupted.

- If the door operation is not working properly and it is unclear whether this is being caused by the signal output or the response of the elevator control, the input into the control system can be checked without the Rx edge connected.

The signal input can be connected to ground to force a permanent non detect state allowing the door(s) to close. Removing this connection and allowing the signal input to 'float' should force the system into a state that holds the door(s) permanently open.

NOTE: The elevator must not be put back into service with the signal input permanently connected to ground.

If after having read and followed this, you are still unsure of the cause of the problem, please contact us in any of the ways shown at the end of this manual.

RESERVED

11. Contact Details

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