TSG

INSTALLATION AND OPERATION INSTRUCTION MANUAL FOR TSG X-RAY INTERLOCK SYSTEM

Cat. TSGDD1423

Manual No. 501013

03-10-08

Version. 1

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1.0 INTRODUCTION

This manual describes the TSG X-Ray Interlock System produced for use in industrial NDT x-ray inspection operations. Contained in this manual are text, diagrams and explanations for the correct installation, safe use and operation of the system.

The installer of this product should consult a professional electrician who is qualified and trained to applicable local and national standards. The installer and operators should read, understand and be familiar with this manual before installation or use of the unit. For technical assistance concerning this product, consult the manufacturer at the below address.

Information in this manual is current and believed accurate as of the date of printing. This manual is subject to change without notice. All software delivered with this system is provided under license agreement. This manual is provided by the manufacturer, exclusively for the system user to whom it is delivered. No part of this manual may be reproduced by or transmitted to any other party user, without the express written consent of the manufacturer. This product is manufactured and distributed by:

Technical Services Group, Inc.
675-C Progress Center Ave.
Lawrenceville, GA 30043
Phone: (770) 822-9117
Fax: (770) 822-5643

CAUTIONS AND WARNINGS

CAUTION: RADIATION HAZARD: This product is designed and produced as an additional safety feature, for use with industrial x-ray systems. X-ray systems produce hazardous x-radiation when energized.

WARNING: RADIATION HAZARD: X-ray equipment may be dangerous to personnel unless established safe exposure procedures are strictly observed.

WARNING: RISK OF ELECTRIC SHOCK: High voltage may be present, always verify that power is disconnected before servicing this unit. Refer servicing to qualified personnel. To prevent fire or shock hazard, do not expose the unit to rain or moisture.

WARNING: Unless instructions furnished for the operation of this equipment are carefully followed, injury to personnel or property may result.

CAUTION: Personnel performing service on this or any electrical equipment should be accompanied by personnel qualified to render emergency first aid.

2.0 SPECIFICATIONS AND WARRANTY

Specifications for the catalog no. 501013 Interlock system are as follows;

Power requirements:	Nominal 110VAC, 5 Amps, 50/60 Hz
	Nominal 220VAC, 3 Amps, 50/60 Hz
Weight:	20 pounds.
Dimensions:	approx. 16” x 18” x 8”
Safety Circuit output:	24 VDC
External lamps output:	10 maximum at 120 VAC, 400mA

WARRANTY

This equipment is guaranteed to be free from defects in materials and workmanship, for a period of one year from date of shipment. This equipment will be repaired or replaced at our option, when the parts or components are returned by prepaid transportation to the manufacturer, (i.e. F.O.B. Lawrenceville, GA). Repair parts and repair labor will be provided at no charge, in order to restore the defective component to specification. All freight charges are the responsibility of the purchaser.

These guarantees apply only if the equipment has been properly installed and has been operated in accordance with the instruction manuals. Warranty does not apply to defects resulting from accidents, alterations, abuse, or misuse. No claims will be accepted under this warranty if repairs are carried out or attempted by persons or service stations not authorized by us.

Technical Services Group, Inc. may not be held responsible or liable for, loss of production, loss of profit, or any other direct or indirect loss, caused by an equipment malfunction arising from use of this product in a manner or for purposes other than described in this manual, misuse or abuse of the equipment.

For warranty questions or claims contact the Service Department at:

Technical Services Group, Inc.

675-C Progress Center Ave.

Lawrenceville, GA 30043.

Phone: (770) 822-9117 Fax: (770) 822-5643

E-Mail: service@tsgxray.com

3.0 DESCRIPTION

The interlock unit provides programmed control of visual and audible warning signals associated with NDT radiography, in shielded and unshielded applications. In unshielded applications, the system operates and monitors the condition of warning lamps, while providing an audible "pre-warning" signal and a 3-second time delay. In shielded applications, the interlock is designed to be installed outside the shielded enclosure, and will also monitor the condition of all interlock switches associated with the shielded radiographic enclosure, in addition to the functions described above.

The interlock unit incorporates a solid state advanced technology programmable logic controller. When installed with a shielded radiography room, the PLC monitors the conditions of the room interlocks, status of the x-ray unit, and operation of the warning beacons. A 'start/exit' sequence allows the operator to ensure that the x-ray room is clear of personnel, monitors the entrance door interlock to prevent operation of the x-ray control if the door has been opened after the pre-warn alarm. Visual and audible alarms on the front panel provide a pre-warning alarm for a minimum of twenty seconds before allowing the initiation of x-rays. A red flashing signal light on the front panel provides indication during "X-ray On" condition.

A panel on the front of the unit provides abbreviated operation instructions. An "Emergency Manual Off" (EMO) push-button on the front panel provides an additional means for personnel to terminate or prevent x-ray operation.

The system is designed specifically to operate with the Lorad LPX series of industrial x-ray systems, but is easily configured to function with other commercially available industrial x-ray systems.

4.0 INSTALLATION INTO AN X-RAY VAULT

INSTALLATION MUST BE PERFORMED BY PERSONS WHO ARE KNOWLEDGABLE OF STANDARD ELECTRICAL CONSTRUCTIONS METHODS AND TECHNIQUES. THE PERSONS INSTALLING THIS EQUIPMENT MUST ALSO BE KNOWLEDGABLE OF NATIONAL AND LOCAL CODES GOVERNING ELECTRICAL CONSTRUCTION AND INSTALLATION. IF THIS UNIT IS TO BE USED IN AN OPEN FACILITY, (FLIGHTLINE MODE), SEE SECTION 5 - 11

1. Mount the Interlock Panel to a wall outside the x-ray room, at a convenient location near the door that will normally be used to exit the room. Mount a Beacon Terminal Box within eight (8) feet of the Interlock Panel. If the installation requires more than five (5) Warning Beacons, mount the second Beacon Terminal Box (***not provided under the procurement contract***) within eight (8) feet of the Interlock Panel. Mount a junction box within eight (8) feet of the Interlock panel, for the purpose of joining the interlock circuit. Mount an additional junction box within eight (8) feet of the Interlock Panel, for the purpose of providing A.C. line power to the Interlock Panel. If a power outlet is already available, this step is not necessary.

   As mounting locations are selected, give consideration to ease of wiring and conduit construction.

2. Mount a recommended dual safety interlock switch at each door of the x-ray room. If the x-ray room is fitted with any shielded maintenance panels, (not for regular access to the x-ray room, and normally bolted closed) mount a limit switch at each maintenance panel.

3. Mount Emergency Shut-Off Switches inside the shielded enclosure, as required. The Interlock Panel is fitted with a single Emergency Shut-Off Switch. An additional Emergency Shut-Off Switch should be mounted inside the shielded enclosure.

4. Mount a Rotating Warning Beacon, Part # ***501013-102*** or equivalent, at each desired location, e.g. outside each door of the shielded enclosure, or at the corners of the shielded enclosure. (***Part # 501013-102 is Federal Signal Corporation, model 121S-120R red rotating light, modified with separate conductors for motor neutral and lamp neutral***).

5. If five or fewer Warning Beacons are permanently mounted to the shielded enclosure, connect the Warning Beacons in the following manner. ***Refer to diagram at page 19 for location of numbered terminals.***

   From the Beacon Terminal Box, provide a single conductor with sufficient current-carrying capacity to operate the motors and lamps of the Warning Beacons, approximately 400mA per each Warning Beacon. Terminate this conductor at Terminal 11 inside the Beacon Terminal Box.

   From the Beacon Terminal Box, provide an individual conductor for EACH Warning Beacon, with sufficient current-carrying capacity to return the current from the lamps of the Warning Beacons, approximately 330mA per each Warning Beacon Lamp. Terminate each of these conductors at Terminals 1 through 5 in the Beacon Terminal Box, as required.

From the Beacon Terminal Box, provide an additional conductor with sufficient current-carrying capacity to return the motor current from all the Warning Beacon Motors, approximately 50 mA per Warning Beacon Motor. Terminate this conductor at Terminal 6 inside the Beacon Terminal Box.

From the Beacon Terminal Box, provide a GROUND conductor to be connected to all the Warning Beacons Motors. Terminate this GROUND conductor at the grounding terminals inside the Beacon Terminal Box.

If six or more (up to a total of ten (10) Warning Beacons are permanently mounted to the shielded enclosure, connect the additional facility beacons according to the instructions above, using the second Beacon Terminal Box provided with the system.

6. Connect all limit switches, door switches and Emergency Shut-Off Switches to form a series switch loop. Return the conductors to a junction box mounted near the Interlock Panel. Connect the two conductors from the series switch loop to the Room Interlock Cable (Metal Circular Connector – Color Coded **BLACK**) that was provided with the system.

7. Connect the Beacon Terminal Box (Metal Circular Connector – Color Coded **RED**) to the Interlock Panel at the corresponding P1 receptacle. If a second Beacon Terminal Box was installed, connect the Metal Circular Connector – Color Coded **BLUE),** at the corresponding P2 receptacle on the Interlock Panel.

   Connect the Room Interlock Circuit (Metal Circular Connector – Color Coded **BLACK**) to the corresponding P6 receptacle on the Interlock Panel.

   Connect the A.C Line power supply (Metal Circular Connector – Color Coded **ORANGE**) to the corresponding P3 receptacle on the Interlock Panel.

   Connect the LORAD interlock cable (Metal Circular Connector – Color Coded **GREEN**) to the corresponding P5 receptacle on the Interlock Panel.

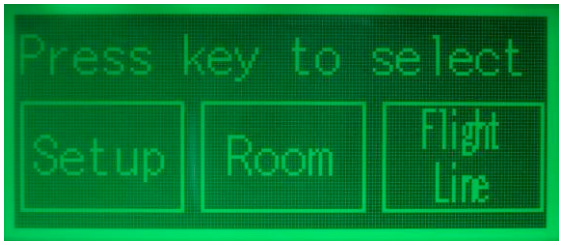
8. When the A.C. Line power supply is connected to the Interlock Panel, the he Touch Screen will illuminate, and the Interlock Panel is ready for Set-up.PROGRAMMING (SET-UP).

5.0 PROGRAMMING (SET-UP)

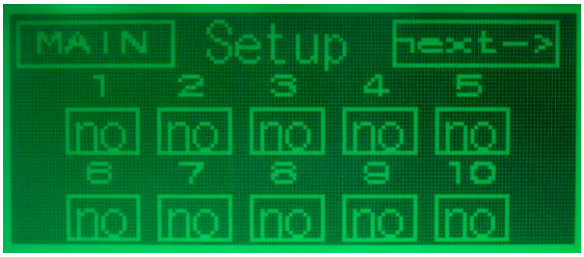
SET-UP FOR X-RAY ROOM OPERATION

1. When A.C. Line power is connected to the Interlock Panel, the Touch Screen LCD will illuminate and the PLC / Touch Screen system will self-test. When self-test is complete, the LCD will display:

2. Press the “MAIN” button on the touch panel, and the LCD will display:

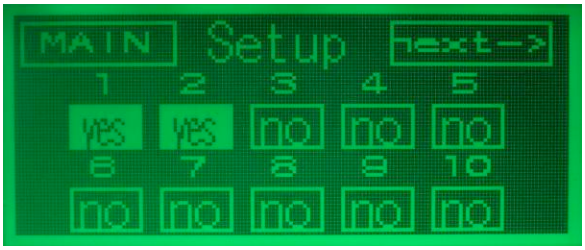


3. Press the “Setup” button on the touch panel, and the LCD will display:



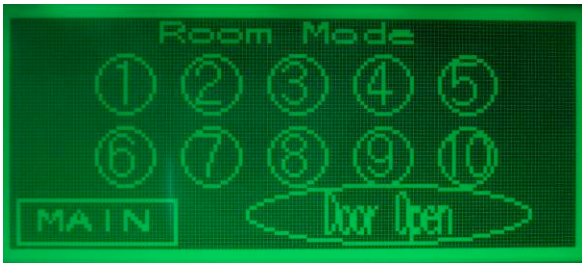
4. This screen is used to switch the monitor function for each Warning Beacon on and off.

   In this screen, no Warning Beacons are selected for monitoring. To enable monitoring of a Warning Beacon, press the square beneath the number of the Warning Beacon to be monitored. The LCD will display:



   This screen indicates that Warning Beacon channels '1' and '2' are selected for monitoring.

   Press the 'MAIN" button and return to the previous screen. Press the 'ROOM' button on the Touch Screen and the LCD will display:



   Note that the beacon numbers are in circles. Press the black "TEST" pushbutton on the front of the Interlock Panel, and the LCD will display:

   When the 'Test' pushbutton is pressed, power is applied to all Warning Beacon circuits, regardless of whether that channel is selected for monitoring. This screen indicates that there are Warning Beacons connected to channels 1 through 5, even though only channels 1 and 2 are selected for monitoring.

Note which numbers change, when pressing the 'Test' pushbutton. Return to the 'Set-up' screen as described in Step 3 above, and select these Warning Beacons for monitoring. After the correct Warning Beacons are selected for monitoring, press the 'MAIN' button on the touch screen.

Press the 'ROOM' button on the touch screen, and the Interlock Panel is programmed for operation in conjunction with your x-ray room.

SET-UP FOR FLIGHTLINE OPERATION

5. Connect the LORAD interlock cable (Metal Circular Connector – Color Coded ***GREEN***) to the corresponding P5 receptacle on the Interlock Panel

   Connect the Beacon Stand cable (Metal Circular Connector – Color Coded ***YELLOW***) to the corresponding P4 receptacle on the Interlock Panel.

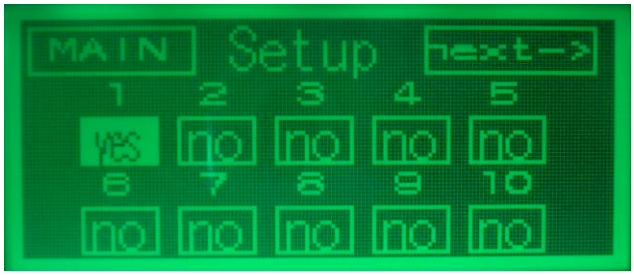
   Connect the A.C Line power supply (Metal Circular Connector – Color Coded ***ORANGE***) to the corresponding P3 receptacle on the Interlock Panel.

   The Interlock Panel is now ready for Setup in Flight Line mode.

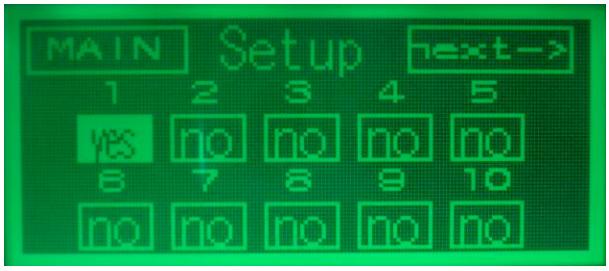
6. When A.C. Line power is connected to the Interlock Panel, the Touch Screen LCD will illuminate and the PLC / Touch Screen system will self-test. When self-test is complete, the LCD will display:

7. Press the "MAIN" button on the touch panel, and the LCD will display:

8. Press the “Setup” button on the touch panel, and the LCD will display:



9. In ‘Flight Line’ Mode, a single Beacon Stand may be connected to the Interlock Panel. The Beacon Stand is assigned to monitoring channel #1. Touch the square below the number 1, and the LCD displays:



10. Touch ‘Main’, then ‘FLIGHTLINE” and the LCD displays:

11. Note that only the indicator for monitoring channel # 1is displayed in the top row, and the message “X-ray On Stand” is displayed. The Interlock Panel is now set up for radiographic operation outside a shielded enclosure. If additional beacons are to be used, (6-10), it is necessary to contact TSG for this optional interface box. This device will provide an interface for up to five (5) additional X-ray On stands. This device is not provided under the procurement contract.

6.0 OPERATION OF THE INTERLOCK PANEL

X-RAY ROOM OPERATION

1. Prepare the test object for x-ray inspection and clear the room of all other personnel

2. Verify that the EMERGENCY OFF pushbutton is pulled out. The operator may press and hold the TEST pushbutton to observe that all of the warning lights and the audible signal are operational.

3. With the door to the x-ray room open, press the Blue 'START' pushbutton. The 'START' pushbutton will illuminate, to indicate that the exit timer and PRE-WARNING are active. During PRE-WARNING, the Audible Alarm, Warning Beacons and the Amber PRE-WARNING Beacon mounted on the top of the Interlock Panel operate for twenty (20) seconds. The exit timer runs from the instant that the START pushbutton is pressed, and continues for an additional three (3) seconds after the PRE-WARNING has ended. The Interlock Panel must sense the closure of the door switch during the exit time. If the door is not closed during this time, it will be necessary to re-start the sequence. If the door interlock switch circuit is opened after exit time elapses, the sequence must be restarted.

4. After completion of the pre-warning, the Audible Alarm, Amber PRE-WARNING Beacon and Warning Beacons will extinguish, and the Interlock Panel's safety circuit contacts are activated allowing the operator to initiate the generation of x-rays.

5. Initiate the x-ray on sequence at the x-ray control unit. The alarm system controller receives the signal from the x-ray control unit that x-rays have been turned on and illuminates the red X-RAY ON Warning Beacon on the top of the Interlock Panel lamp and the external Warning Beacons.

6. Each time the operator re-enters the x-ray room, the above sequences must be repeated.

7. If at any time the red EMERGENCY OFF pushbutton is pressed, the operation sequence will be aborted and initiation of x-ray unit inhibited To reset the system pull the EMERGENCY OFF pushbutton to the out position.

8. Failure of any Warning Beacon will abort the sequence and x-ray generation will be inhibited until the failure is corrected and the system is reset. Press and hold the TEST button to observe the operational status of Warning Beacon lamps. Replace the failed bulb and press the TEST pushbutton to confirm the function of the bulb that was replaced. The system will reset, providing that all lamps are functioning properly.

Table 6-1 TSG X-Ray Interlock System, Controls and Indicators

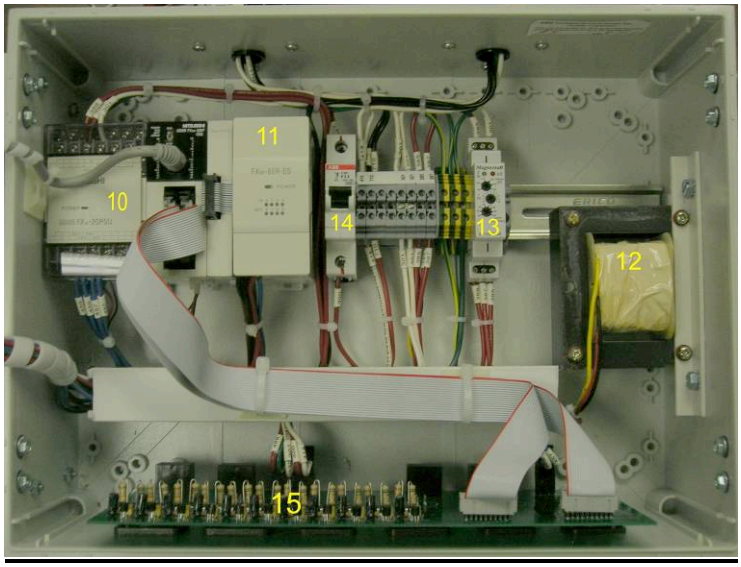
1.	Instruction Panel	Panel displays abbreviated operating instructions for system.
2.	START Pushbutton (Blue)	Press to start exit sequence. Lamp will be illuminated steady during exit time.
3.	PRE-WARN Beacon (Amber)	Illuminates and rotates during PRE-WARNING.
4.	Audible Alarm	Activated (long non-pulsing tone) during pre-warning delay.
5.	X-RAY ON Beacon (Red)	Illuminates and rotates during the generation of x-rays.
6.	TEST Pushbutton	Press to illuminate all Warning Beacons, and activate audible alarm.
7.	EMERGENCY OFF Pushbutton (Red)	Mushroom type push-pull button, when pushed interrupts 24vdc supply to safety circuits, and aborts operation of system. Pull to reset system.

7.0 PARTS LIST

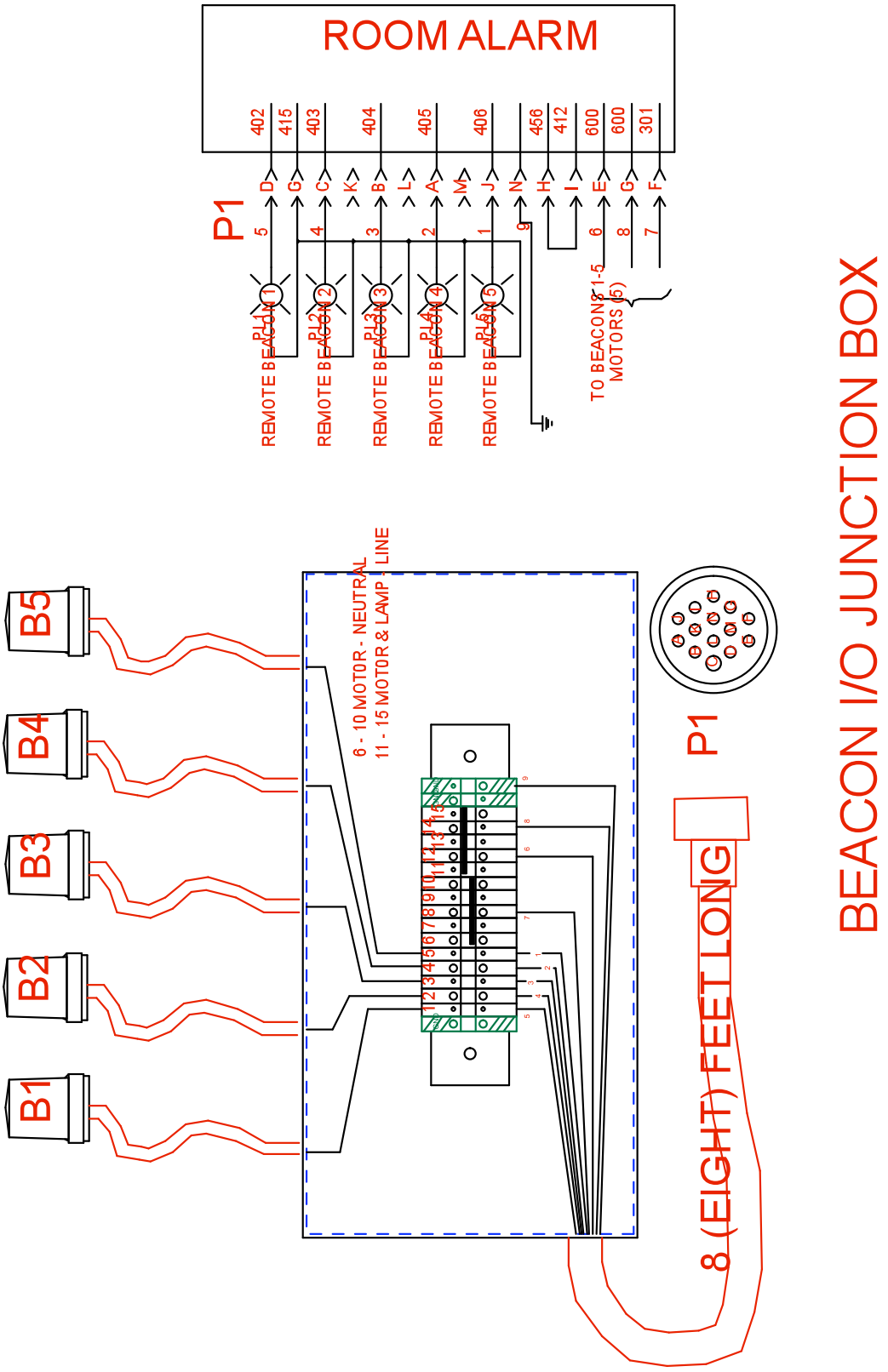
Item No.	TSG Part No	Description
1	501013	Interlock Panel System Includes:
		Interlock Panel, Beacon Stand, One (1) Beacon Terminal Boxes, AC Power Cable, Beacon Stand Cable, LORAD Interlock Cable, X-ray Room Interlock Cable, and Transport Cases
2	501013-101	Amber PRE-WARNING Beacon
3	501013-102	Red X-RAY ON Warning Beacon
4	501013-103	Replacement Lamp for Warning Beacon
5	501013-104	Test Pushbutton, flush-black
6	501013-105	EMO Push-Pull Button, (red mushroom, 24V)
7	501013-106	Blue, Illuminated 'START' Pushbutton
8	501013-107	Replacement Lamp for 'START Pushbutton
9	501013-108	Audible Alarm
10	501013-109	24VDC Power Supply
11	501013-110	Programmable Logic Controller
12	501013-111	110V – 220V Switchover Transformer
13	501013-112	AC Line Voltage Sensor
14	501013-113	Circuit Breaker, 5 amp
15	501013-114	Lamp Current Monitoring Circuit Board
16	501013-115	LORAD Interlock Cable
17	501013-116	X-ray Room Interlock Cable
18	501013-117	AC Power Cable
19	501013-118	Beacon Terminal Box, ***RED***
20	501013-119	Beacon Terminal Box, ***BLUE(optional)***
21	501013-120	Transport Case for Interlock Panel
22	501013-200	"X-ray On" Beacon Stand
23	501013-201	Cast Acrylic Lens for "X-ray On" Sign
24	501013-202	Replacement Lamp for "X-ray On" Sign
25	501013-203	Beacon Stand Cable, 100' Length
26	501013-204	Transport Case for Beacon Stand
27	501013-300	Optional I/O Junction box for 5 Beacon Stands

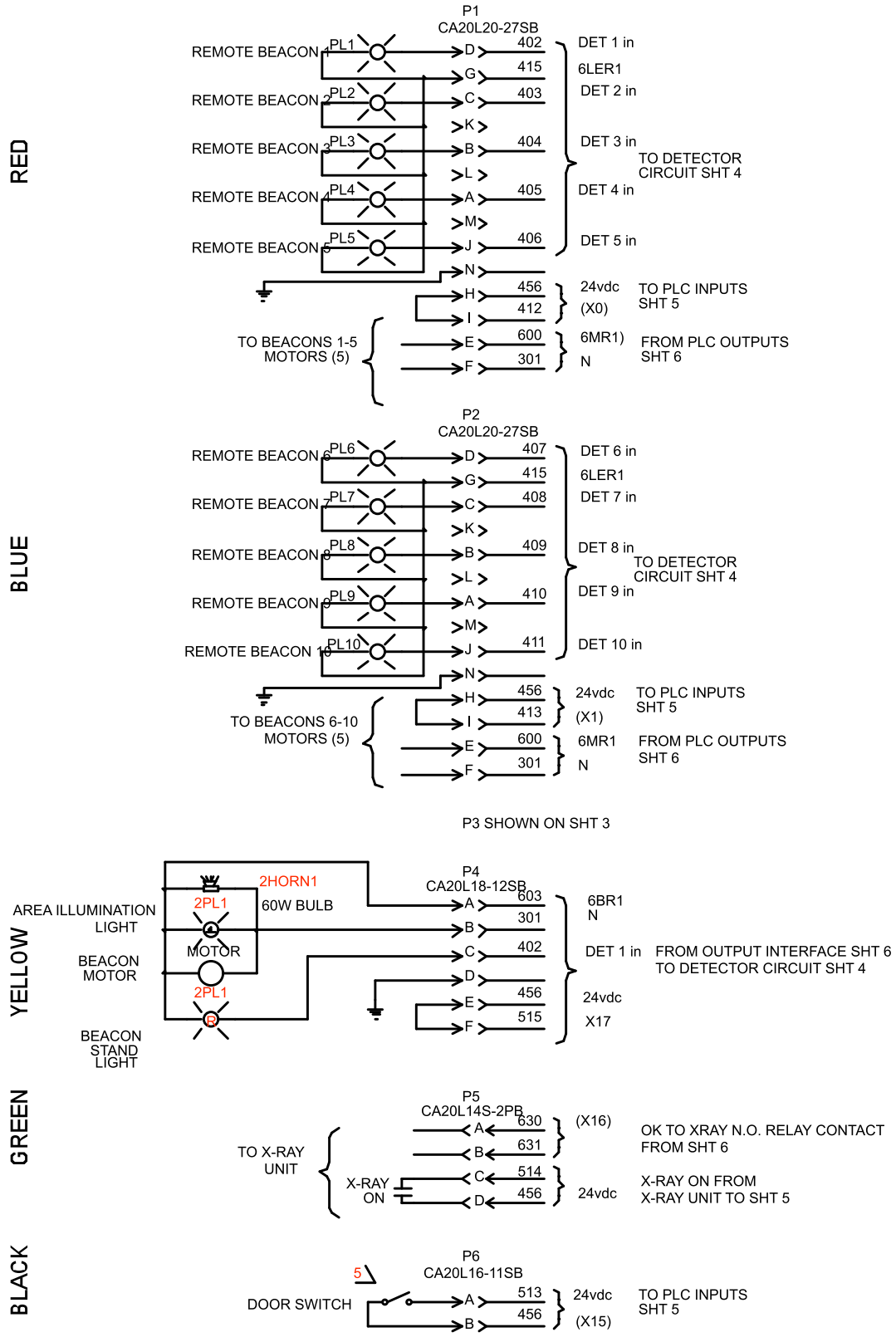
FIGURE 7-1

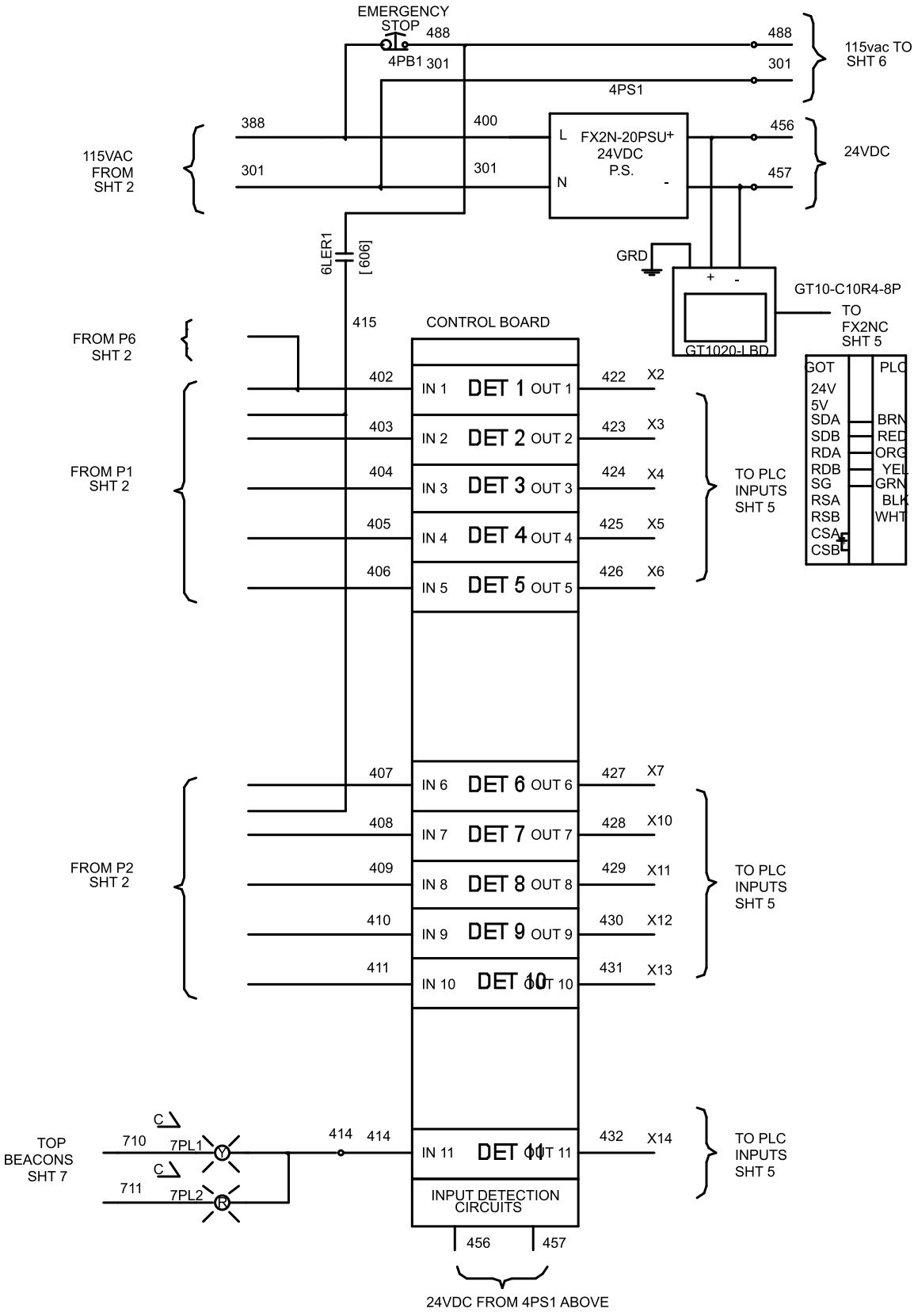
FIGURE 7.2

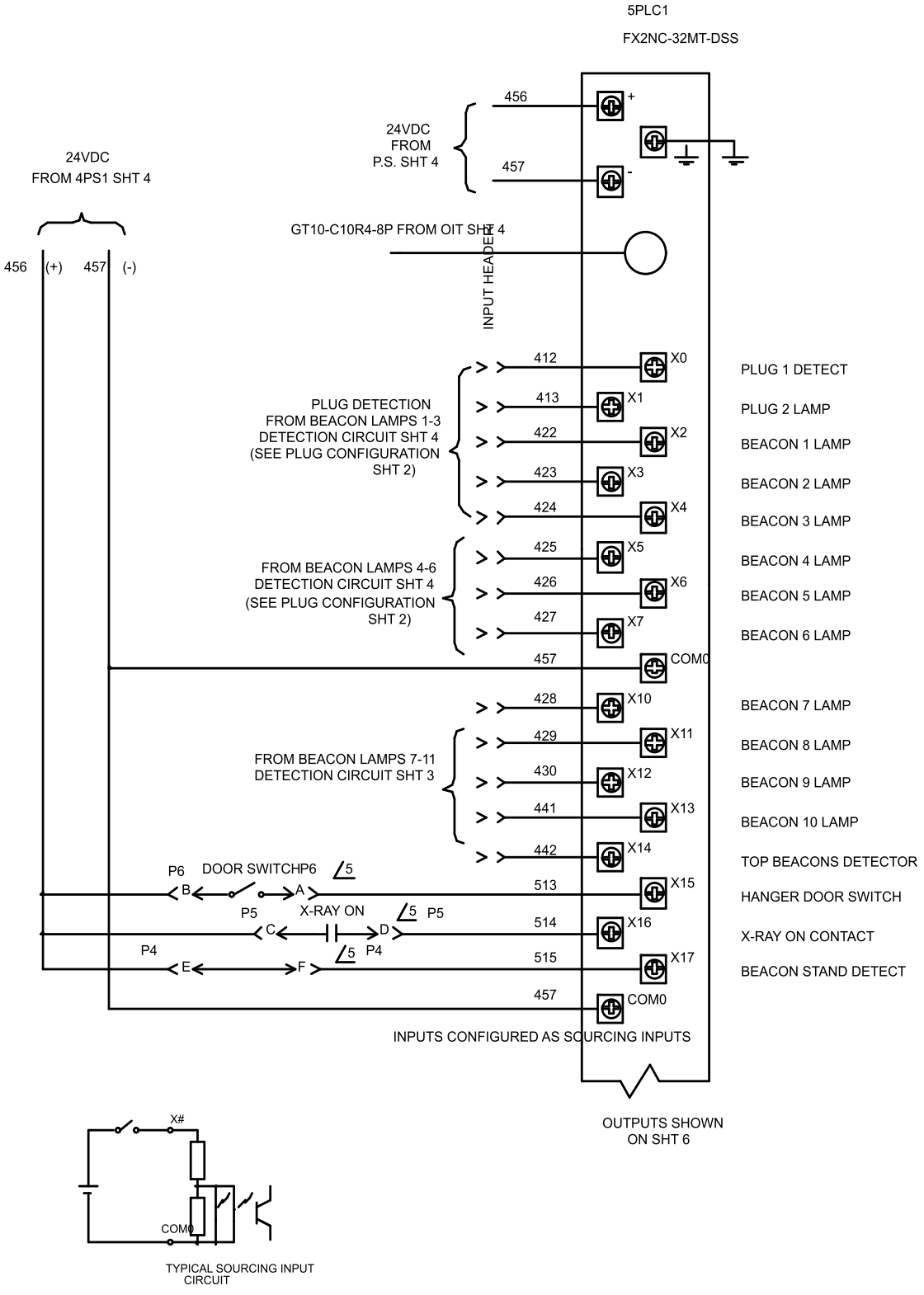


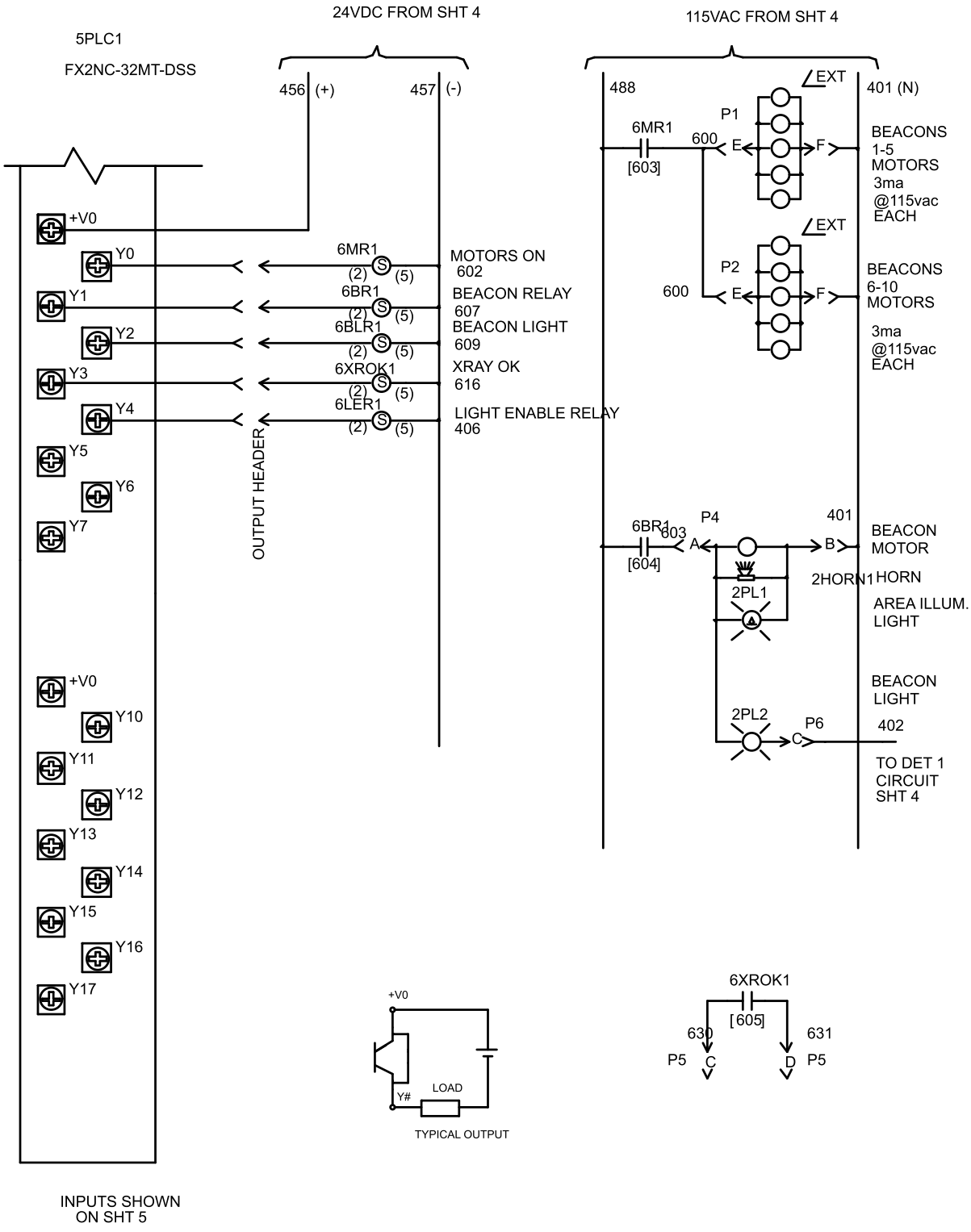
8.0 DRAWINGS

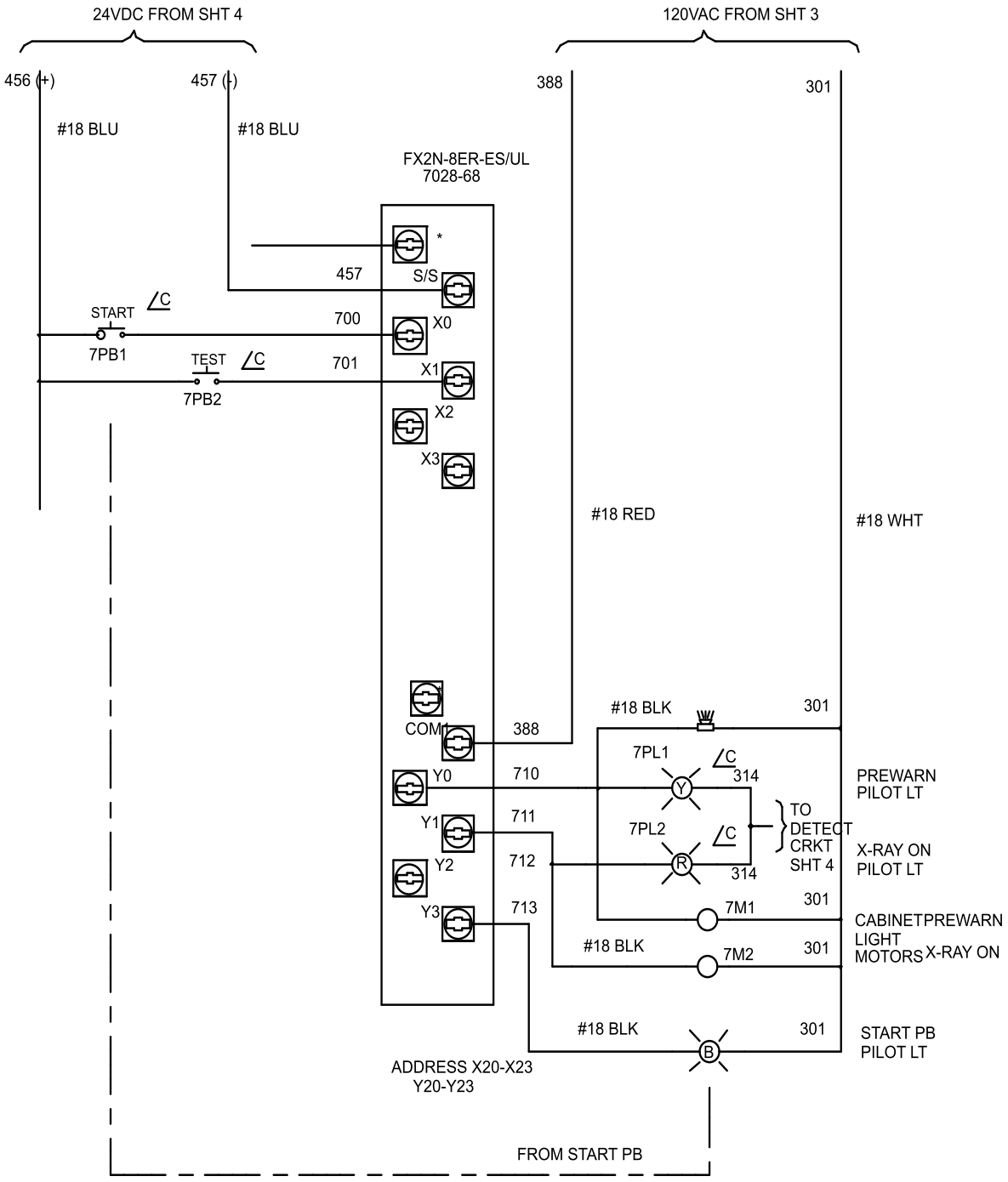

ROOM ALARM
402
415
403
404
405
406
456
412
600
600
301
P1
D
G
C
K
B
L
A
M
J
N
H
I
E
G
F
5
4
3
2
1
9
6
8
7
PL1
PL2
PL3
PL4
PL5
REMOTE BEACON 1
REMOTE BEACON 2
REMOTE BEACON 3
REMOTE BEACON 4
REMOTE BEACON 5
TO BEACON 1-5
MOTORS (5)
B5
B4
B3
B2
B1
6 - 10 MOTOR - NEUTRAL
11 - 15 MOTOR & LAMP - LINE
P1
8 (EIGHT) FEET LONG
BEACON I/O JUNCTION BOX

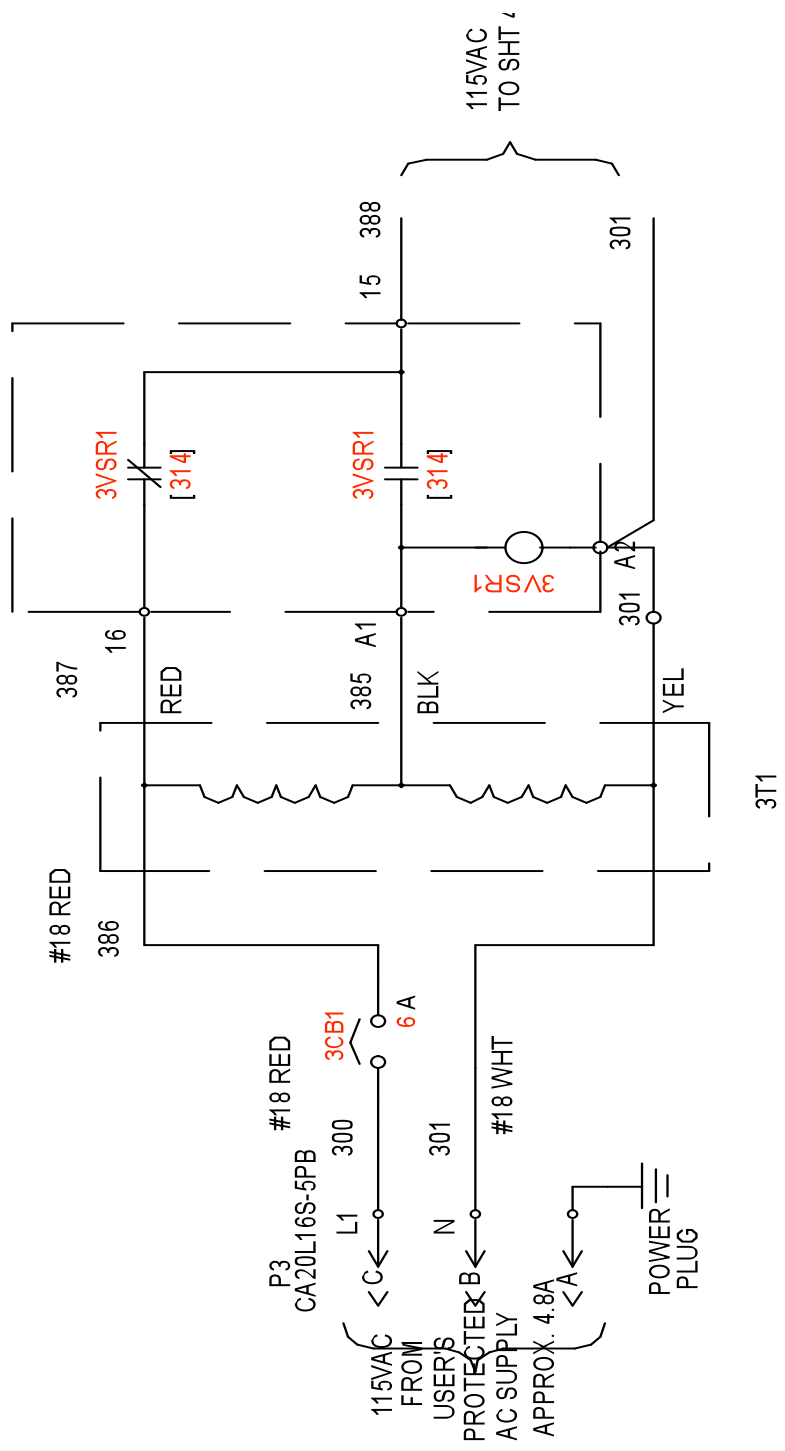

RED
P1
CA20L20-27SB
REMOTE BEACON 1
PL1
REMOTE BEACON 2
PL2
REMOTE BEACON 3
PL3
REMOTE BEACON 4
PL4
REMOTE BEACON 5
PL5
D
G
C
K
B
L
A
M
J
N
H
I
E
F
402
415
403
404
405
406
456
412
600
301
DET 1 in
6LER1
DET 2 in
DET 3 in
DET 4 in
DET 5 in
TO DETECTOR CIRCUIT SHT 4
24vdc
(X0)
TO PLC INPUTS SHT 5
TO BEACONS 1-5 MOTORS (5)
6MR1)
N
FROM PLC OUTPUTS SHT 6
BLUE
P2
CA20L20-27SB
REMOTE BEACON 6
PL6
REMOTE BEACON 7
PL7
REMOTE BEACON 8
PL8
REMOTE BEACON 9
PL9
REMOTE BEACON 10
PL10
407
415
408
409
410
411
DET 6 in
6LER1
DET 7 in
DET 8 in
DET 9 in
DET 10 in
TO DETECTOR CIRCUIT SHT 4
456
413
600
301
24vdc
(X1)
6MR1
N
TO PLC INPUTS SHT 5
FROM PLC OUTPUTS SHT 6
TO BEACONS 6-10 MOTORS (5)
P3 SHOWN ON SHT 3
YELLOW
AREA ILLUMINATION LIGHT
BEACON MOTOR
BEACON STAND LIGHT
2HORN1
2PL1
60W BULB
MOTOR
2PL1
P4
CA20L18-12SB
603
301
402
456
515
6BR1
N
DET 1 in
24vdc
X17
FROM OUTPUT INTERFACE SHT 6
TO DETECTOR CIRCUIT SHT 4
GREEN
P5
CA20L14S-2PB
TO X-RAY UNIT
X-RAY ON
630
631
514
456
(X16)
24vdc
OK TO XRAY N.O. RELAY CONTACT FROM SHT 6
X-RAY ON FROM X-RAY UNIT TO SHT 5
BLACK
P6
CA20L16-11SB
5
DOOR SWITCH
513
456
24vdc
(X15)
TO PLC INPUTS SHT 5

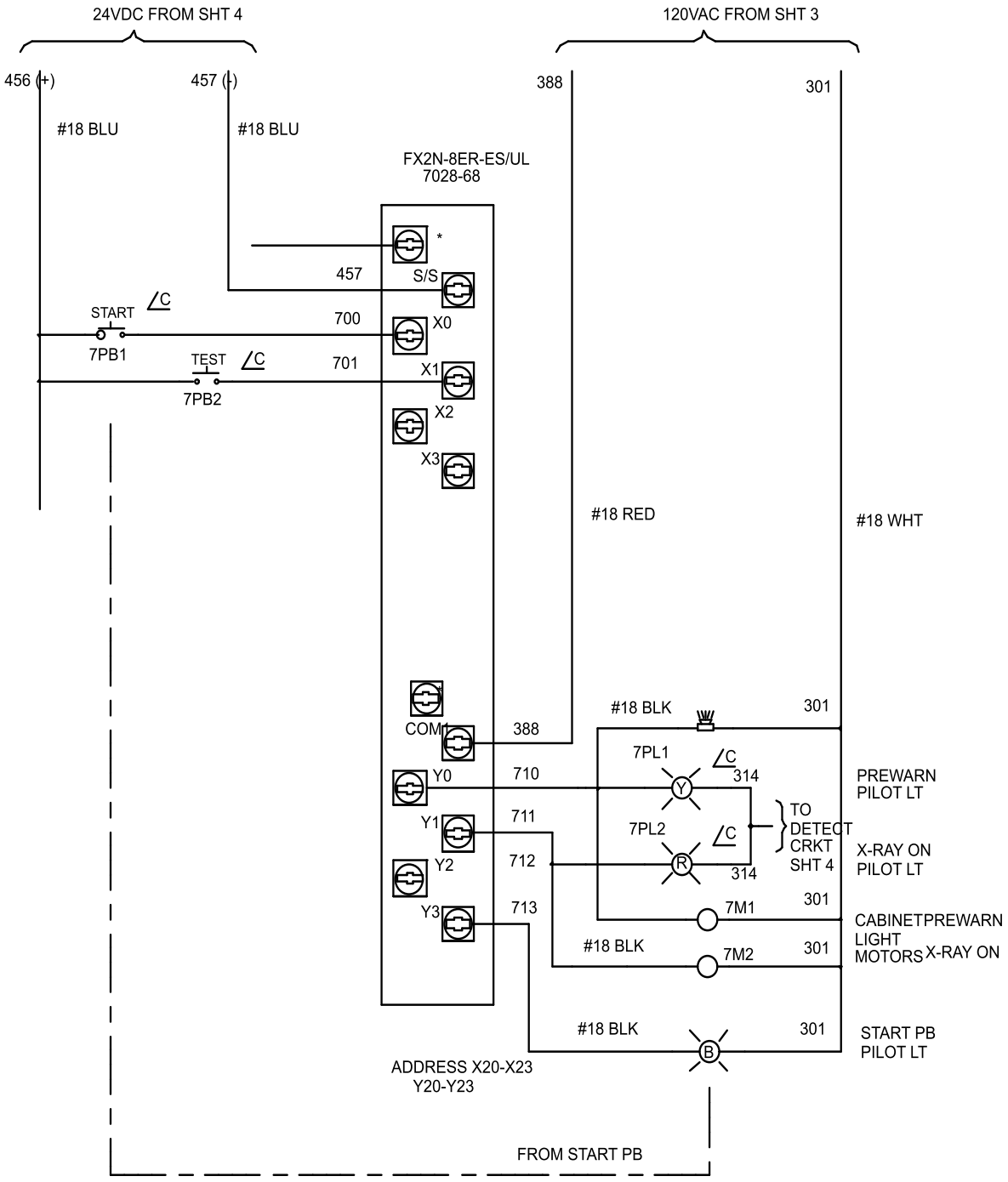

EMERGENCY STOP
4PB1
488
301
4PS1
488
301
115vac TO SHT 6
115VAC FROM SHT 2
388
301
400
301
FX2N-20PSU+
24VDC
P.S.
L
N
-
456
457
24VDC
6LER1
[606]
GRD
+
-
GT1020-LBD
GT10-C10R4-8P
TO FX2NC SHT 5
GOT
PLC
24V
5V
SDA
SDB
RDA
RDB
SG
RSA
RSB
CSA
CSB
BRN
RED
ORG
YEL
GRN
BLK
WHT
FROM P6 SHT 2
415
CONTROL BOARD
FROM P1 SHT 2
402
403
404
405
406
IN 1
IN 2
IN 3
IN 4
IN 5
DET 1
DET 2
DET 3
DET 4
DET 5
OUT 1
OUT 2
OUT 3
OUT 4
OUT 5
422
423
424
425
426
X2
X3
X4
X5
X6
TO PLC INPUTS SHT 5
FROM P2 SHT 2
407
408
409
410
411
IN 6
IN 7
IN 8
IN 9
IN 10
DET 6
DET 7
DET 8
DET 9
DET 10
OUT 6
OUT 7
OUT 8
OUT 9
OUT 10
427
428
429
430
431
X7
X10
X11
X12
X13
TO PLC INPUTS SHT 5
TOP BEACONS SHT 7
C
710
7PL1
Y
C
711
7PL2
R
414
414
IN 11
DET 11
OUT 11
432
X14
TO PLC INPUTS SHT 5
INPUT DETECTION CIRCUITS
456
457
24VDC FROM 4PS1 ABOVE

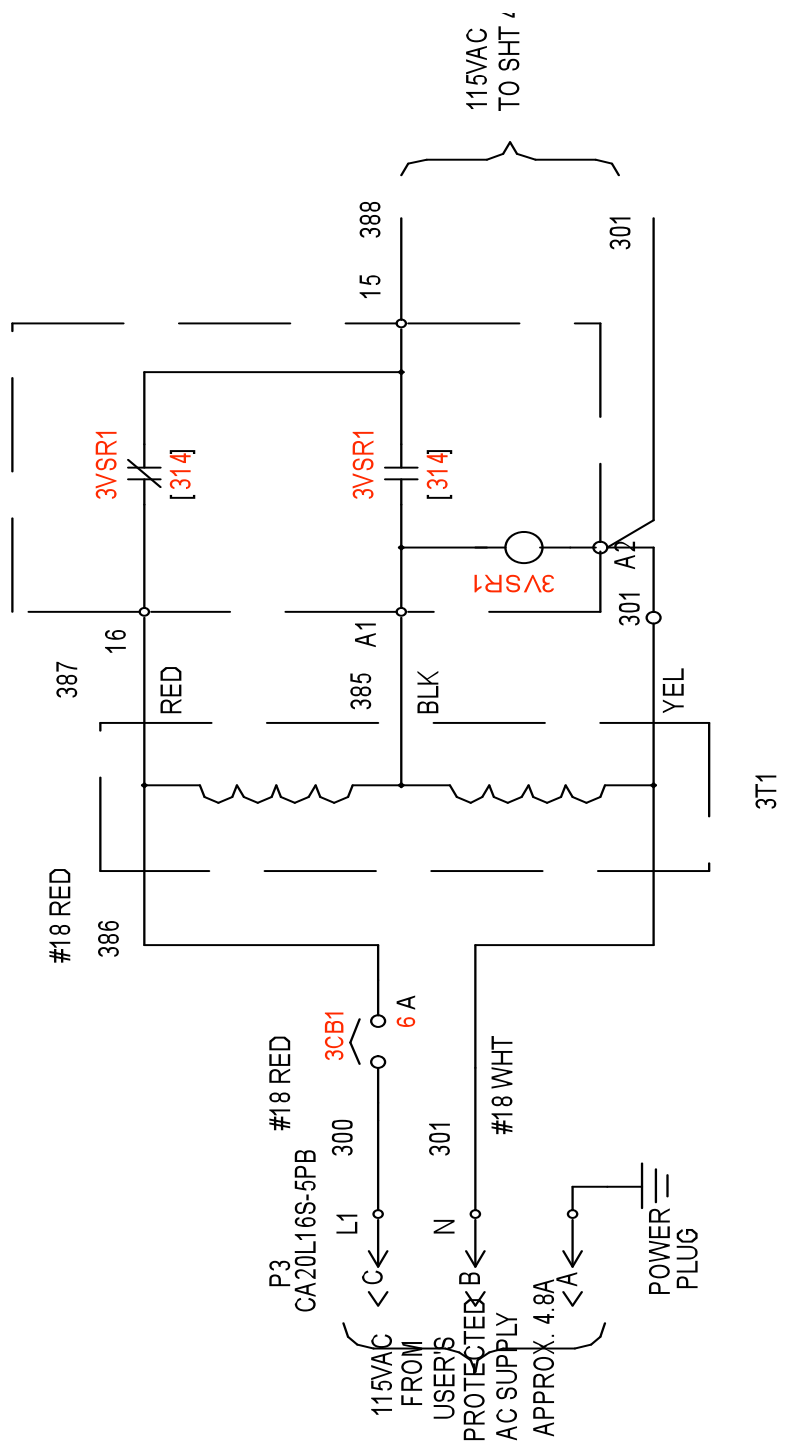

5PLC1
FX2NC-32MT-DSS
24VDC
FROM 4PS1 SHT 4
456 (+) 457 (-)
24VDC
FROM
P.S. SHT 4
456
457
+
-
GT10-C10R4-8P FROM OIT SHT 4
INPUT HEADER
PLUG DETECTION
FROM BEACON LAMPS 1-3
DETECTION CIRCUIT SHT 4
(SEE PLUG CONFIGURATION
SHT 2)
FROM BEACON LAMPS 4-6
DETECTION CIRCUIT SHT 4
(SEE PLUG CONFIGURATION
SHT 2)
FROM BEACON LAMPS 7-11
DETECTION CIRCUIT SHT 3
412
413
422
423
424
425
426
427
457
428
429
430
441
442
513
514
515
457
X0
X1
X2
X3
X4
X5
X6
X7
COM0
X10
X11
X12
X13
X14
X15
X16
X17
COM0
PLUG 1 DETECT
PLUG 2 LAMP
BEACON 1 LAMP
BEACON 2 LAMP
BEACON 3 LAMP
BEACON 4 LAMP
BEACON 5 LAMP
BEACON 6 LAMP
BEACON 7 LAMP
BEACON 8 LAMP
BEACON 9 LAMP
BEACON 10 LAMP
TOP BEACONS DETECTOR
HANGER DOOR SWITCH
X-RAY ON CONTACT
BEACON STAND DETECT
P6
DOOR SWITCHP6
5
B
A
P5
X-RAY ON
5
P5
C
D
5
P4
P4
E
F
INPUTS CONFIGURED AS SOURCING INPUTS
OUTPUTS SHOWN
ON SHT 6
X#
COM0
TYPICAL SOURCING INPUT
CIRCUIT


24VDC FROM SHT 4
115VAC FROM SHT 4
5PLC1
FX2NC-32MT-DSS
456 (+)
457 (-)
488
401 (N)
EXT
P1
6MR1
600
E
F
[603]
BEACONS
1-5
MOTORS
3ma
@115vac
EACH
EXT
P2
600
E
F
BEACONS
6-10
MOTORS
3ma
@115vac
EACH
+V0
Y0
Y1
Y2
Y3
Y4
Y5
Y6
Y7
OUTPUT HEADER
6MR1
(2) S (5)
MOTORS ON
602
6BR1
(2) S (5)
BEACON RELAY
607
6BLR1
(2) S (5)
BEACON LIGHT
609
6XROK1
(2) S (5)
XRAY OK
616
6LER1
(2) S (5)
LIGHT ENABLE RELAY
406
6BR1
[604]
603
P4
A
401
B
BEACON
MOTOR
2HORN1
HORN
2PL1
AREA ILLUM.
LIGHT
BEACON
LIGHT
2PL2
P6
C
402
TO DET 1
CIRCUIT
SHT 4
+V0
Y10
Y11
Y12
Y13
Y14
Y15
Y16
Y17
+V0
Y#
LOAD
TYPICAL OUTPUT
6XROK1
[605]
630
631
P5
C
D
P5
INPUTS SHOWN
ON SHT 5


24VDC FROM SHT 4
120VAC FROM SHT 3
456 (+)
457 (-)
388
301
#18 BLU
#18 BLU
FX2N-8ER-ES/UL
7028-68
*
457
S/S
START
C
700
X0
7PB1
TEST
C
701
X1
7PB2
X2
X3
#18 RED
#18 WHT
COM1
388
#18 BLK
301
7PL1
C
Y0
710
314
PREWARN
PILOT LT
Y1
711
7PL2
C
TO
DETECT
CRKT
SHT 4
Y2
712
314
X-RAY ON
PILOT LT
301
Y3
713
7M1
CABINETPREWARN
LIGHT
MOTORS
#18 BLK
7M2
301
X-RAY ON
#18 BLK
301
START PB
PILOT LT
ADDRESS X20-X23
Y20-Y23
FROM START PB


115VAC
TO SHT
388
15
301
3VSR1
[314]
3VSR1
[314]
3VSR1
A2
301
387
16
A1
385
RED
BLK
YEL
3T1
#18 RED
386
3CB1
6 A
#18 RED
300
#18 WHT
301
P3
CA20L16S-5PB
L1
N
C
B
A
115VAC
FROM
USER'S
PROTECTED
AC SUPPLY
APPROX. 4.8A
POWER
PLUG


24VDC FROM SHT 4
120VAC FROM SHT 3
456 (+)
457 (-)
388
301
#18 BLU
#18 BLU
FX2N-8ER-ES/UL
7028-68
*
457
S/S
START
C
700
X0
7PB1
TEST
C
701
X1
7PB2
X2
X3
#18 RED
#18 WHT
COM1
388
#18 BLK
301
7PL1
C
Y0
710
314
PREWARN
PILOT LT
Y1
711
7PL2
C
TO
DETECT
CRKT
SHT 4
Y2
712
314
X-RAY ON
PILOT LT
301
Y3
713
7M1
CABINETPREWARN
LIGHT
MOTORS
#18 BLK
7M2
301
X-RAY ON
#18 BLK
301
START PB
PILOT LT
ADDRESS X20-X23
Y20-Y23
FROM START PB


115VAC
TO SHT
388
15
301
3VSR1
[314]
3VSR1
[314]
3VSR1
A2
301
387
16
A1
RED
385
BLK
YEL
3T1
#18 RED
386
6 A
3CB1
#18 RED
300
#18 WHT
301
P3
CA20L16S-5PB
L1
N
C
B
A
115VAC
FROM
USER'S
PROTECTED
AC SUPPLY
APPROX. 4.8A
POWER
PLUG

9.0 Testing Plan for 501013 Interlock System

Select the components necessary to constitute a complete Interlock System, including:

One Interlock Device
One 'X-ray On' Beacon Stand
One Beacon Stand Cable – 100 ft. length (Yellow)
One Power Cable (Orange)
One Interconnect Cable (Green)
One Door Switch Cable (Black)

Place the Interlock Device on the test stand, and release the latches that hold the Interlock device sealed, closed.

Connect the Power cable to the Interlock Device, and to a nominal 120VAC power source, then observe the following:

1.) Front Panel Touch Screen Display shows TSG "Startup Screen".

Open the Interlock Device Front Cover and observe the following:

2,) FX2N-20 PSU power supply unit has 'Power' LED illuminated
3.) FX2N -8ER-ES PLC unit has 'Power' LED illuminated
4.) 831-VS-120 Voltage Sensing Relay has 'Power' LED illuminated.

Close and latch front cover.

5.) Connect two "Beacon Test" stands to the Interlock Device, via the 'Red' and 'Blue' Cannon Plugs, and observe that the Front Panel Touch Screen automatically switches to "Room" mode.

6.) Press "Set-up" on the Front Panel Touch Screen, and observe that the 'Set-up" screen is displayed.

7.) Select each of the ten available beacons, by touching the "NO" square above each number, 1 to 10, and observe that the "NO" square changes to a lighted "YES".

8.) Touch the "Next" button in the Front Panel Touch Screen, and observe that 20 second "Exit" time is displayed.

9.) Touch the "Change" button in the Front Panel Touch Screen, and observe that 60 second "Exit" time is displayed.

10.) Touch the "Next" button in the Front Panel Touch Screen, and observe that 20 second "Exit" time is displayed.

11.) Touch the “Back” button in the Front Panel Touch Screen, and observe that “Set-up Screen from step XXXX above is displayed.

12.) Touch the “Main” button in the Front Panel Touch Screen, and observe that the “MODE” screen is displayed.

13.) Touch the “Room” button in the Front Panel Touch Screen, and observe that the “Room Mode” screen is displayed. There are ten “Beacon Indicators”, circles, each with a number from 1 to 10. A “Main” button and a “Door Open” light are below the beacon indicators.

14.) Press the “Test” pushbutton, and observe that the sounder, mounted on the Interlock Device is audible, while the Test pushbutton is depressed.

15.) Also observe that the Amber and Red Beacons, mounted atop the Interlock Device illuminate and rotate while the Test pushbutton is depressed.

16.) Also observe that a Beacon Indicator lights up for each beacon that is connected to the Interlock Device.

17.) Press the “Start” pushbutton, and observe that the sounder is audible while the Start pushbutton is depressed.

18.) Also observe that the Amber Beacon, mounted atop the Interlock Device illuminates and rotates while the Start pushbutton is depressed.

19.) Release the Start Pushbutton and observe that the sounder and beacon cease operating.

20.) Connect a ‘Door Switch’ cable (P 6, Black) to the Interlock Device. Using a wire nut, and taking care to avoid contacting any conductive surfaces or materials, connect the two conductors of the Door Switch cable. Observe that, as the two conductors make contact, the “Door Open” light in the Front Panel Touch Screen lights up.

21.) Also observe that the text “Door Open” changes to “Door Closed”.

22.) Press the “Start” pushbutton, and observe that the 20-second pre-warning interval begins, with the Amber ‘Pre-warning’ beacon illuminated and rotating and the sounder in ‘audible’ state.

23.) Also observe that the ‘Pre-warning’ continues after the “Start” pushbutton is released.

24.) Press the “Test” pushbutton, and observe that the pre-warning interval is halted.

25.) Press the “Start” pushbutton, commencing the 20-second pre-warning interval. Disconnect the ‘Door Switch’ cable, and observe that the ‘Pre-warning’ interval is halted.

Re-connect the ‘Door Switch’ cable

26.) Press the “Start” pushbutton, commencing the 20-second pre-warning interval. Press the Red “EMO” pushbutton, and observe that the ‘Pre-warning interval is halted.

27.) Also observe that the display switches to a flashing RED screen, with “EMO” displayed.

28.) Re-set the “EMO” pushbutton, and observe that flashing “EMO” screen persists.

29.) Touch the ‘Main’ button inside the flashing “EMO” screen, and observe that the screen changes to the “MODE” screen.

Connect a ‘Lorad Simulator’ to the Interlock Device via the Interconnect Cable.

30.) Press the “Start” pushbutton, commencing the 20-second pre-warning interval. Observe that the ‘Lorad Simulator’ indicates a completed safety circuit, after the 20-second pre-warning interval has elapsed.

31.) Also observe that the ‘complete safety circuit’ condition ends after three seconds.

32.) Press the “Start” pushbutton, commencing the 20-second pre-warning interval. Within three seconds of the end of ‘Pre-warning’, simulate ‘X-ray Start’ using the ‘Lorad Simulator’. Observe that the Red Beacon, mounted atop the Interlock Device illuminates and rotates.

33.) Also observe that all connected beacons are illuminated and rotating.

34.) Simulate ‘X-ray Stop’, using the ‘Lorad Simulator’, and observe that the Red Beacon, mounted atop the Interlock Device extinguishes and stops rotating.

35.) Also observe that all connected beacons extinguish and stop rotating.

36.) Press the “Start” pushbutton, commencing the 20-second pre-warning interval. Within three seconds of the end of ‘Pre-warning’, simulate ‘X-ray Start’ using the ‘Lorad Simulator’. Disconnect “Beacon Test” stand connected at P1. Observe that the ‘Lorad Simulator’ indicates ‘Incomplete Safety Circuit’.

37.) Also observe that the corresponding monitoring channels (1 through 5) for the beacons in this test stand are extinguished in the display.

Reconnect “Beacon Test” stand at P1.

Simulate ‘X-ray Stop’, using the ‘Lorad Simulator’.

38.) Press the “Start” pushbutton, commencing the 20-second pre-warning interval. Within three seconds of the end of ‘Pre-warning’, simulate ‘X-ray Start’ using the ‘Lorad Simulator’.

Disconnect “Beacon Test” stand connected at P2. Observe that the ‘Lorad Simulator’ indicates ‘Incomplete Safety Circuit’.

39.) Also observe that the corresponding monitoring channels (6 through 10) for the beacons in this test stand are extinguished in the display.

Reconnect “Beacon Test” stand at P2.

Simulate ‘X-ray Stop’, using the ‘Lorad Simulator’.

40.) Press the “Start” pushbutton, commencing the 20-second pre-warning interval. Within three seconds of the end of ‘Pre-warning’, simulate ‘X-ray Start’ using the ‘Lorad Simulator’. Disconnect ‘Door Switch’ P6. Observe that the ‘Lorad Simulator’ indicates ‘Incomplete Safety Circuit’.

Simulate ‘X-ray Stop’, using the ‘Lorad Simulator’.

41.) Connect the “X-ray On” beacon stand at P4 of the Interlock Device. Observe that the display switches to a RED screen, with the message ”P4 with P2 Only”.

42.) Also observe that there is a “MAIN” button in this display.

Disconnect the “Beacon Test” stands at P1 and P2

43.) Touch the “MAIN” button and observe that the display switches to the ‘MODE” screen.

Disconnect the “X-ray On” beacon stand at P4 of the Interlock Device.

Disconnect the Power connector at P3.

Disconnect the ‘Door Switch’ cable at P6.

Connect the Power connector at P3.

44.) Connect the “X-ray On” beacon stand at P4. Observe that the display switches to “FLIGHTLINE MODE”.

45.) Press the “Start” pushbutton, commencing the 20-second pre-warning interval. Within three seconds of the end of ‘Pre-warning’, simulate ‘X-ray Start’ using the ‘Lorad Simulator’. Disconnect “X-ray On” Beacon Stand at base of beacon stand, and observe that the ‘Lorad Simulator’ indicates “Incomplete Safety Circuit”.

46.) Also observe that the Display does not indicate an operational beacon at beacon 1.

47.) Also observe that the “X-ray On” beacon stand is extinguished, and that the beacon is not rotating.

Simulate ‘X-ray Stop’, using the ‘Lorad Simulator’.

Disconnect AC Line power, by removing AC plug from wall outlet.

48.) Connect Interlock Device to nominal 220VAC line, using line doubling transformer, and observe that the Interlock Device displays the TSG “Startup Screen”.

49.) Press the “Start” pushbutton, commencing the 20-second pre-warning interval. Within three seconds of the end of ‘Pre-warning’, simulate ‘X-ray Start’ using the ‘Lorad Simulator’, and observe that the beacon and “X-ray On” sign in the “X-ray On” beacon stand are illuminated, and that the beacon is rotating.

50.) Also observe that the sounder in the “X-ray On” beacon stand is audible.

Simulate ‘X-ray Stop’, using the ‘Lorad Simulator’.

End of Test.