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Revision B
October 2017

FPD for Gas Chromatographs

Hardware Reference Manual

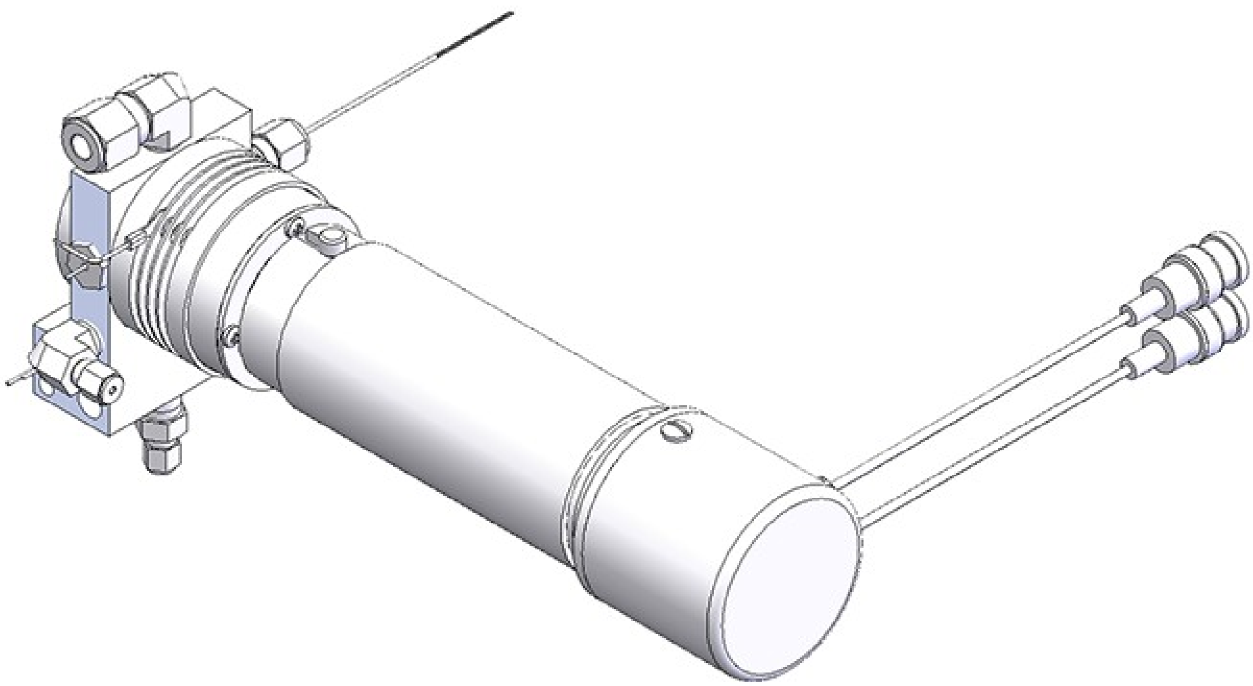

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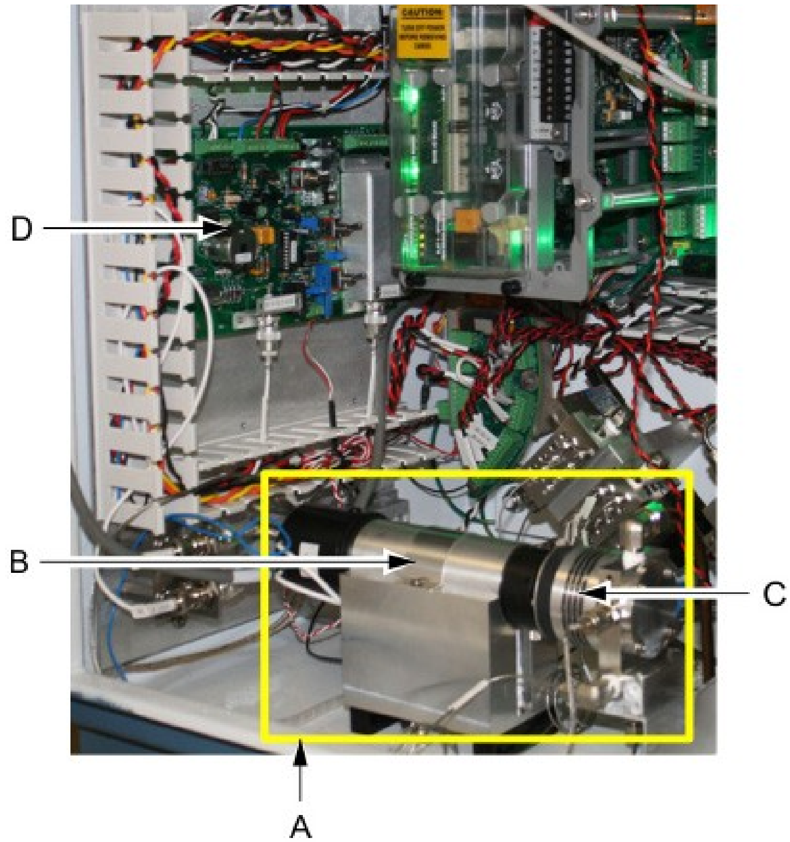
Table of Contents

1 Introduction

The flame photometric detector (FPD) that you have received is factory-engineered to be used in conjunction with all Rosemount gas chromatographs. The FPD can be used as a solitary detector to measure low levels of sulfur compounds in natural gas or as a secondary detector in conjunction with a thermal conductivity detector (TCD) that allows the GC to analyze the full range of components present in a natural gas sample, including sulfur compounds.

Figure 1-1: Flame Photometric Detector (FPD)



A. *Flame photometric detector (FPD)*

B. *Photomultiplier tube*

C. *Flame cell*

D. *Electrometer board*

An FPD (A) typically consists of the following major components:

The *flame cell* (C) - Located in the lower enclosure, the flame cell has connections for fuel gas, hydrocarbon-free air,sample injection (process gas plus nitrogen carrier), and an exhaust pipe. It is fitted with an RTD to monitor the temperature when running, and an ignitor to light the fuel gas.

The *photomultiplier tube* (B) - Located in the lower enclosure, the photomultiplier tube contains the sensors that measure the light that is emitted from the flame cell during operation. It has one signal lead and one high voltage wire that take the signal from the detector to the electrometer board and provide the power for ignition. The leads are co-axial typecables.

The *electrometer board* (D) - Located in the upper enclosure, the electrometer board amplifies and processes the signal data from the detector, and sends it to the CPU board on the GC. It also provides the ignition circuit, controls the re-light function, and generates the flame out alarm.

1.1 Theory of operation

NOTICE

See also Section 1.3 of this manual, for definitions of some of the terminology used in the following explanations.

The detection system in the FPD uses the reactions of sulfur components in a hydrogen or air flame as a source for analytical detection. The source of the FPD's signal is derived from the light produced by an excited molecule created in the flame's combustion, which is a photochemical process called *chemiluminescence*.

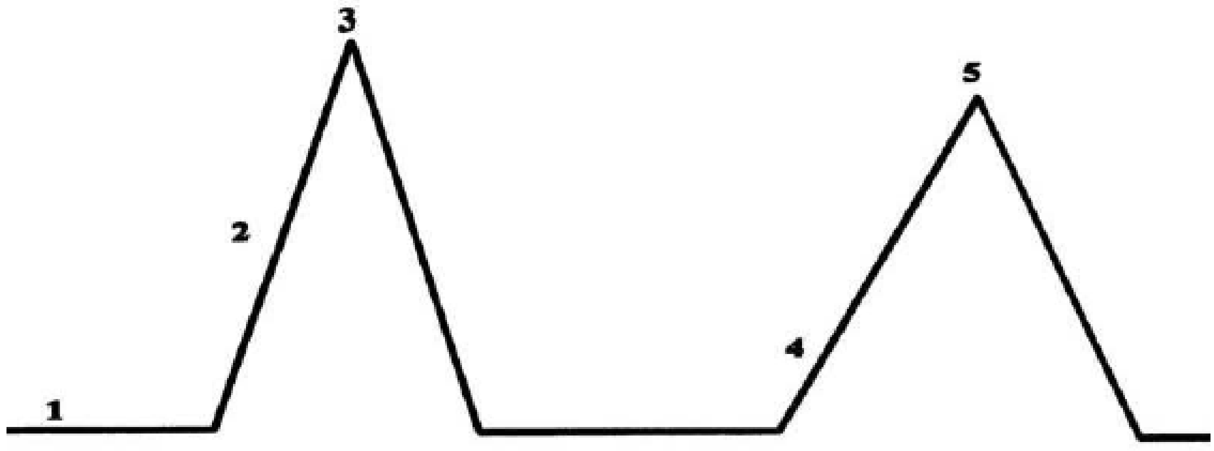
A thermocouple is fitted to the flame cell to ensure that the flame is present. If the flame is not detected, the electrometer shuts off the hydrogen to the flame cell. It then supplies a voltage to the igniter, waits five seconds and opens the hydrogen shut off valve. The electrometer will make ten ignition attempts if necessary. If it is not successful, then the hydrogen is shut off, an alarm is triggered on the GC and the unit awaits attention from the operator.

NOTICE

To ignite the flame manually, see Section 3.1.1.

The signal is sent from the PMT to the electrometer to be amplified. The electrometer also provides the PMT with the high voltage it requires to operate the auto re-light circuits.1.3

Figure 1-2: Elution of Components



1. *Carrier gas only at the detector*
2. *First component begins to elute from the columns and is sensed by the detector.*
3. *Peak concentration of first component.*
4. *The second component begins to elute from the columns and is sensed by the detector.*
5. *Peak concentration of the second component.*

The signal is then sent to the preamplifier board for further amplification. In addition, the preamplifier converts each voltage signal to a value that is proportional to the concentration of the component detected in the gas sample. The preamplifier provides four different gain channels as well as compensation for baseline drift. The signals are sent to the GC for computation or for viewing on a PC monitor or local operator interface(LOI).

While the GC is in *Idle* mode, prior to injecting a sample, the detector is exposed to pure carrier gas. In this condition, the output from the detector is electrically nulled. The detector output is set to 1 mV DC. This is measured on the red and black terminals on the preamplifier board, and adjusted using the potentiometer (R38) on the electrometer PCB.

1.2 Equipment description

FPDs are available in the following configurations:

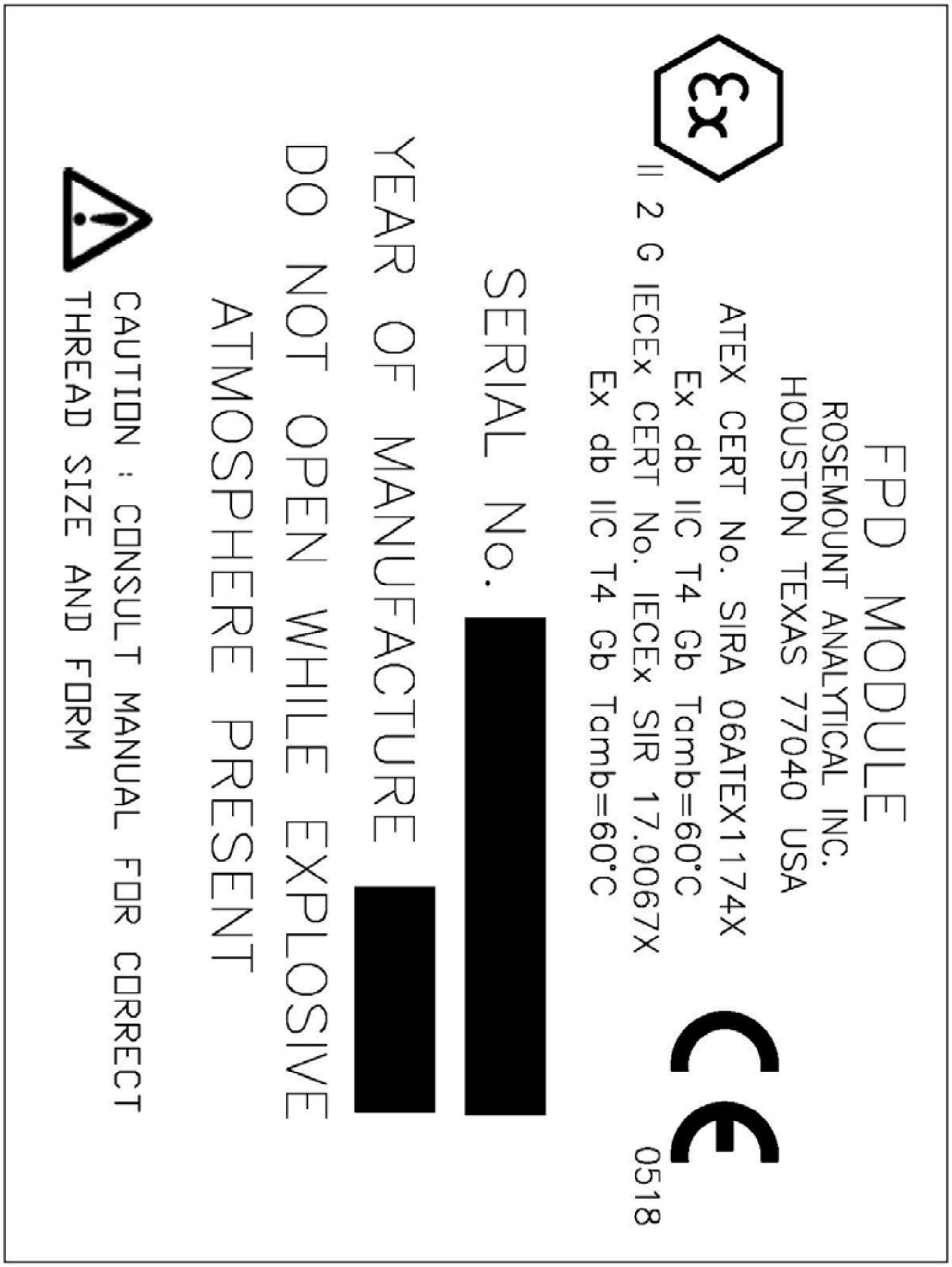
- Model 500 FPD
- Model 700 FPD
- Model 700 FPD Front Entry
- 700XA FPD
- 700XA FPD Front Entry
- 1500XA FPD

NOTICE

The Front Entry configurations include an additional frame to allow all the FPD enclosures to be mounted on the front of the unit. This allows the unit to be located close to a wall because no rear access is required for installation or maintenance.

All configurations are ATEX-certified. The differences between the configurations are detailed in later sections of this chapter.

The FPD used with the Model 500, 700, and 700XA gas chromatographs has the following hazardous area certification markings:



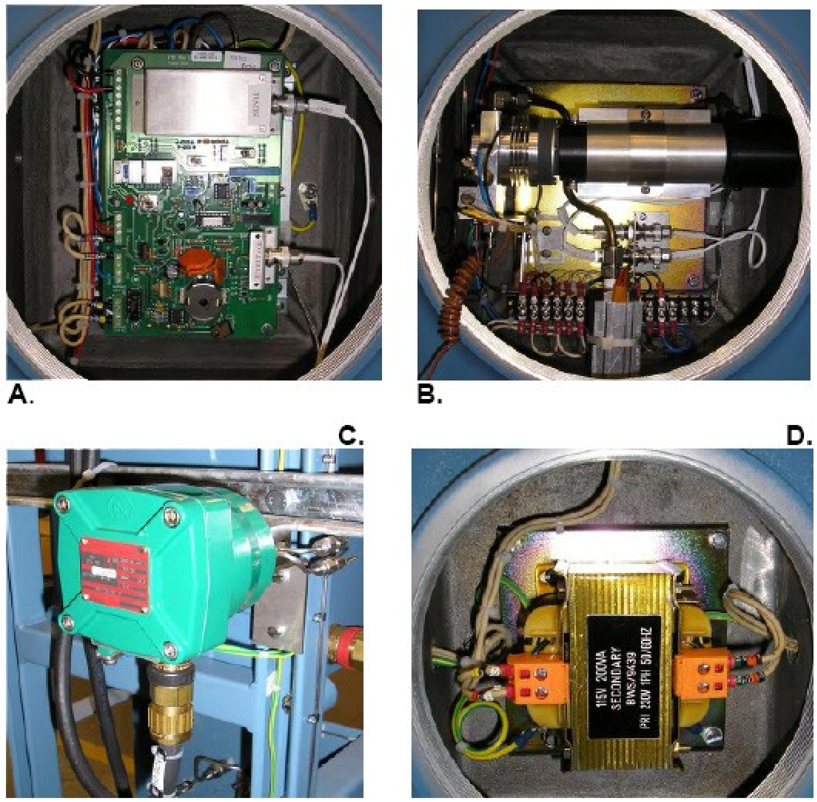
1.2.1 Model 500 FPD

Figure 1-3: Model 500 FPD

The Model 500 FPD module consists of three Exd GUB enclosures mounted on a frame, plus an Exd solenoid that acts as a hydrogen shut-off valve. The enclosures contain the following:

- Electrometer assembly in GUB 5 enclosure
- Flame cell and photometric detector tube in GUB 5 enclosure
- Transformer (either 230/110 Vac or 110/110 Vac) in GUB 4 enclosure
- Hydrogen shut-off valve

Figure 1-4: Model 500 FPD Enclosures



A. Electrometer assembly

B. Flame cell and FP tube

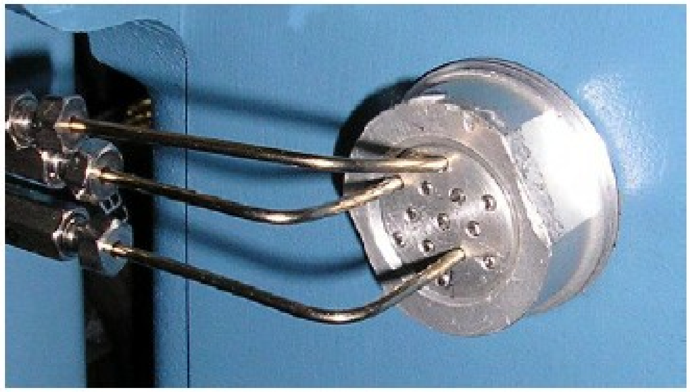
C. H_2 shut off valve

D. Transformer

Place the FPD module as close as possible to its partner GC to minimize the length of sample tubing between them, and therefore to keep the cycle time as short aspossible.

The tubing required to operate the FPD flame cell is 1/16 in. OD 0.010 in. ID. All tubing enters the GUB enclosure containing the flame cell via a specially designed tubing gland. All internal fittings are Swagelok double ferrule type compression fittings.

Figure 1-5: Specialized Tubing Gland



1.2.2 Model 700 FPD

Figure 1-6: Model 700 FPD

The Model 700 FPD module consists of four Exd GUB enclosures mounted on a frame, plus an Exd solenoid valve that acts as a hydrogen shut-off valve. The Model 700 FPD requires an additional enclosure to house temperature control equipment that on a Module 500 GC is available internally.

The enclosures contain the following:

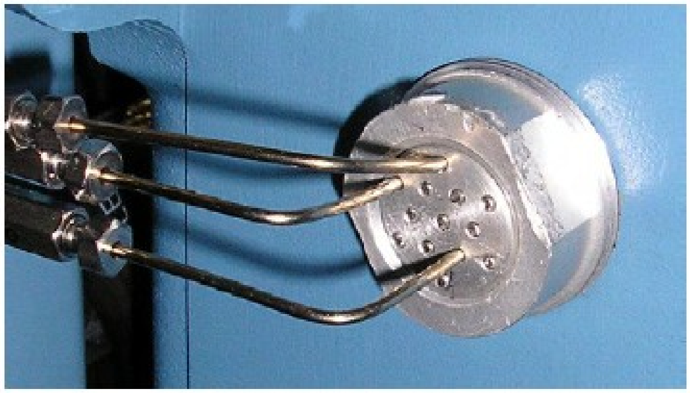
- Electrometer assembly in GUB 5 enclosure
- Flame cell and photometric detector tube in GUB 5 enclosure
- PID Temperature controller and relay
- Transformer (either 230/110 Vac or 110/110 Vac) in GUB 4 enclosure
- Hydrogen shut-off valve

Figure 1-7: PID Temperature Controller and Relay

Place the FPD module as close as possible to its partner GC to minimize the length of sample tubing between them, and therefore to keep the cycle time as short as possible.

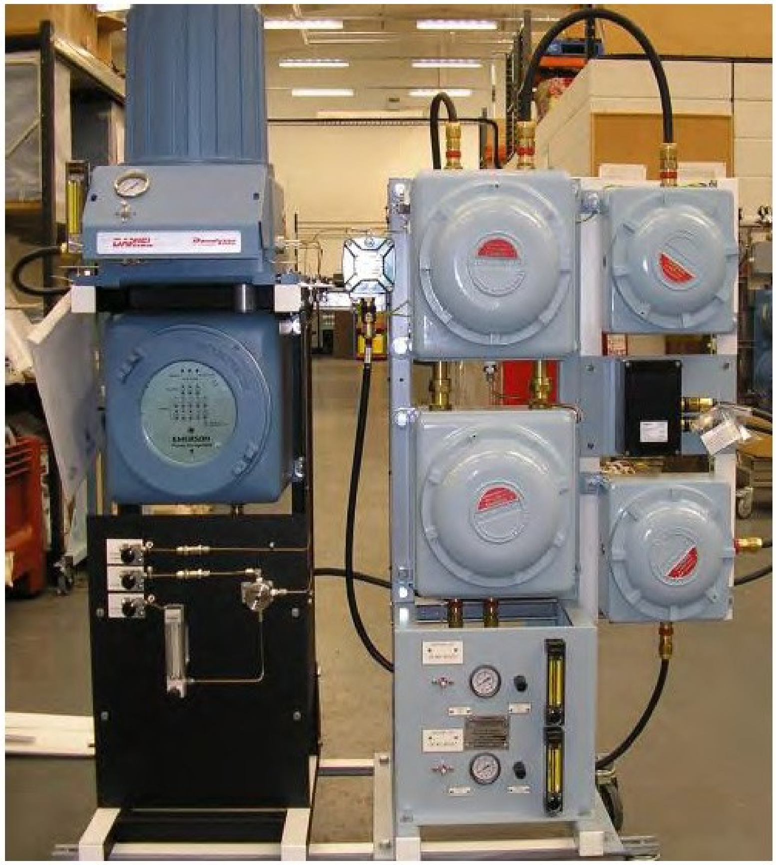
The tubing required to operate the FPD flame cell is 1/16 in. OD 0.010 in. ID. All tubing enters the GUB enclosure containing the flame cell via a specially designed tubing gland. All internal fittings are Swagelok double ferrule type compression fittings.

Figure 1-8: Specialized Tubing Gland



1.2.3 Model 700 FPD front entry

Figure 1-9: Model 700 FPD Front Entry



The Model 700 FPD front entry is comprised of the same components as the standard Model 700 FPD with an additional frame added to allow all the enclosures to be mounted on the front of the unit. This allows the unit to be located close to a wall because no rear access is required for installation ormaintenance.

1.2.4 Model 700XA FPD

Figure 1-10: Model 700XA FPD

The Model 700XA FPD consists of four explosion-proof enclosures mounted on a frame plus an explosion-proof solenoid valve that acts as a hydrogen shut-off valve.

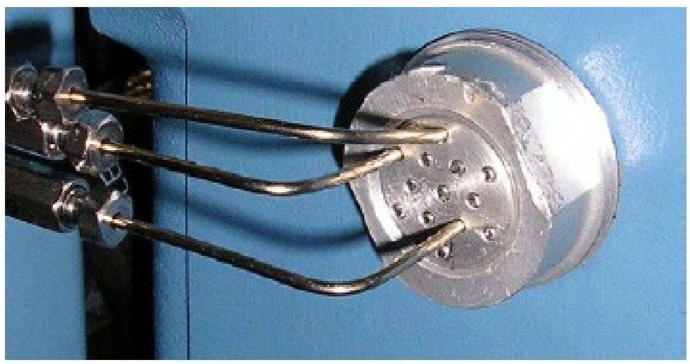
The enclosures contain the following components:

- Electrometer assembly
- Flame cell and photometric detectortube
- Transformer, either a 230/110 Vac or a 110/110 Vac
- PID temperature controller and relay
- Hydrogen shut-off valve

Place the FPD as close as possible to its partner GC to minimize the length of sample tubing between them, and keep the cycle time as short as possible.

The tubing size required to operate the FPD flame cell is 1/16 in. OD 0.010 in. ID. All tubing enters the flame cell's enclosure through a specially designed tubing gland. All internal fittings are Swagelok double ferrule compression fittings.

Figure 1-11: Specialized Tubing Gland

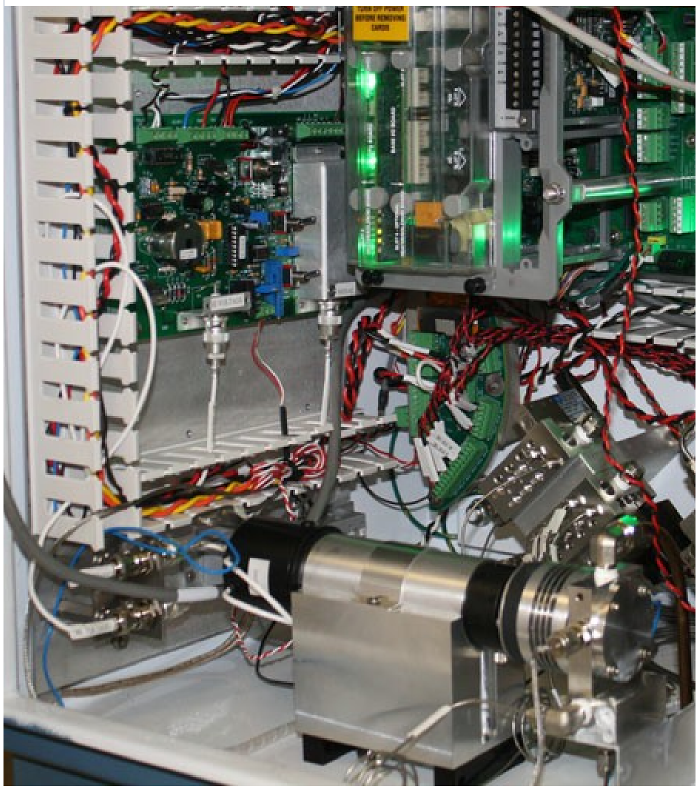


1.2.5 Model 700XA FPD front entry

The Model 700XA FPD front entry is comprised of the same components as the standard Model 700XA FPD with an additional frame added to allow all the enclosures to be mounted on the front of the unit. This allows the unit to be located close to a wall, because no rear access is required for installation or maintenance.

1.2.6 Model 1500XA FPD

Figure 1-12: Model 1500XA FPD



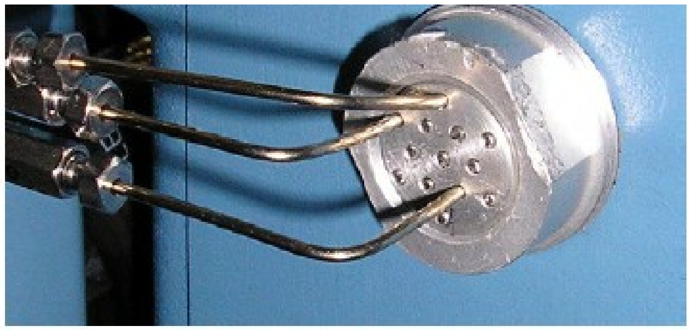
The Model 1500XA FPD consists of four explosion-proof enclosures mounted on a frame plus an explosion-proof solenoid valve that acts as a hydrogen shut-off valve. The enclosures contain the following components:

- Electrometer assembly
- Flame cell and photometric detectortube
- Transformer, either a 230/110 Vac or a 110/110 Vac
- PID temperature controller and relay
- Hydrogen shut-off valve

Place the FPD as close as possible to its partner GC in order to minimize the length of sample tubing between them, and therefore to keep the cycle time as short as possible.

The tubing size required to operate the FPD flame cell is 1/16 in. OD 0.010 in. ID. All tubing enters the flame cell's enclosure through a specially designed tubing gland. All internal fittings are Swagelok double ferrule compression fittings.

Figure 1-13: Specialized Tubing Gland



1.3 Glossary

Auto Zero

Automatic zeroing of the preamplifier. May be entered into the controller to take place at any time during the analysis when either the component is not eluting or the baseline is steady (not normally used).

Chromatogram

A permanent record of the detector output. A chromatograph is obtained from a PC interfaced with the detector output through the GC controller. A typical chromatogram displays all component peaks and gain changes. It may be viewed in color as it is processed on a PC VGA display. Tick marks recorded on the chromatogram by the GC Controller indicate where timed events takeplace.

Component

Any one of several different gases that may appear in a sample mixture. For example, sample gas usually contains the following components: ethyl mercaptan, t-butyl mercaptan, methyl ethyl sulphide, diethyl sulphide, hydrogen sulphide, and carbonyl sulphide.

Response Factor

Correction factor for each component as determined by the calibration. It is defined by the equation:

$$ARF_n = \frac{Area_n}{Cal_n} \quad \text{or} \quad HRF_n = \frac{Ht_n}{Cal_n}$$

where

ARF_n = Area response factor for component *n* in area per mole percent (%)

HRF_n = Height response factor for component *n*

$Area_n$ = Area associated with component *n* in calibration gas

Ht_n = Height associated with component *n* in mole % in calibration gas

Cal_n = Amount of component *n* in mole % in calibration gas

Retention time

The time in seconds that elapses between the start of analysis (0 seconds) and the sensing of the maximum concentration of each component by the analyser detector.

2 Setup

2.1 Gas connections

Use Silcosteel® or equivalent tubing for all calibration gas and process gas connections on all FPDs that are used to measure low range sulfur components. If you use Grade 316 or other stainless steel piping, the sulfur components will adhere to the internal surface of the pipe, and will continue to do so until the entire internal surface of the tubing is coated or *conditioned*, which will result in lower than expected levels of sulfur components reaching the detector for measurement. Conditioning may take one week or longer, depending on the levels of sulfur components and the length of the tubing.

2.2 Environmental Considerations

FPDs are sensitive to changes in temperature and pressure; therefore, place them in shelters that have stable temperature and pressure. Do not use positive pressurization for shelters.

2.3 Utility gases

FPDs require the following utility gases:

- Hydrogen - 99.995% purity
- Hydrocarbon-free air
- Nitrogen - 99.995% purity (carrier gas)
- Helium - 99.995% purity (optional second carrier gas)

Make all utility and process gas connections with Swagelok® 1/8-inch double ferrule compression fittings. Metric conversion kits are available; contact your Rosemount sales representative for more information.

These are typical values supplied for information only. Actual values are application specific.

Figure 2-1: Typical Pressure and Flow Rate Information

GAS	SUPPLY PRESSURE	TYPICAL FLOWRATE
HYDROGEN	5 BAR	120 CC/MIN
HC FREE AIR	5 BAR	200 CC/MIN
NITROGEN	8 BAR	15 CC/MIN
SAMPLE GAS	3 BAR	100 CC/MIN

GAS	CYLINDER SIZE	RECOMMENDED QTY
HYDROGEN	50 LITRE / 200 BAR	2
HC FREE AIR	50 LITRE / 200 BAR	2
NITROGEN	50 LITRE / 200 BAR	1

2.4 Venting

All Rosemount FPD modules have a vent from the flame cell that exits the GUB enclosure via a proprietary Exd breather/drain/ flame arrestor assembly. The exhaust from the flame cell emits water vapor as a result of burning hydrogen as fuel. This vapor condenses in the exhaust tubing outside the GUB enclosure, and can be seen as drips of water.

Vent the FPD exhaust to atmosphere. Do not subject the vent to any back pressure because this will have a detrimental effect on the detector, and may cause the flame to extinguish.

WARNING

Hydrogen-air mixtures can ignite with very low energy input. For reference, an invisible spark or a static spark from a person can cause ignition. Although the auto- ignition temperature of hydrogen is higher than those for most hydrocarbons, hydrogen's lower ignition energy makes the ignition of hydrogen–air mixtures more likely.

Use a container with the FPD module to collect the condensed water from the FPD vent. Do not pipe the vent away unless you can guarantee a continuous downward slope on the pipe and no back pressure or obstruction by water.

3 Operation and maintenance

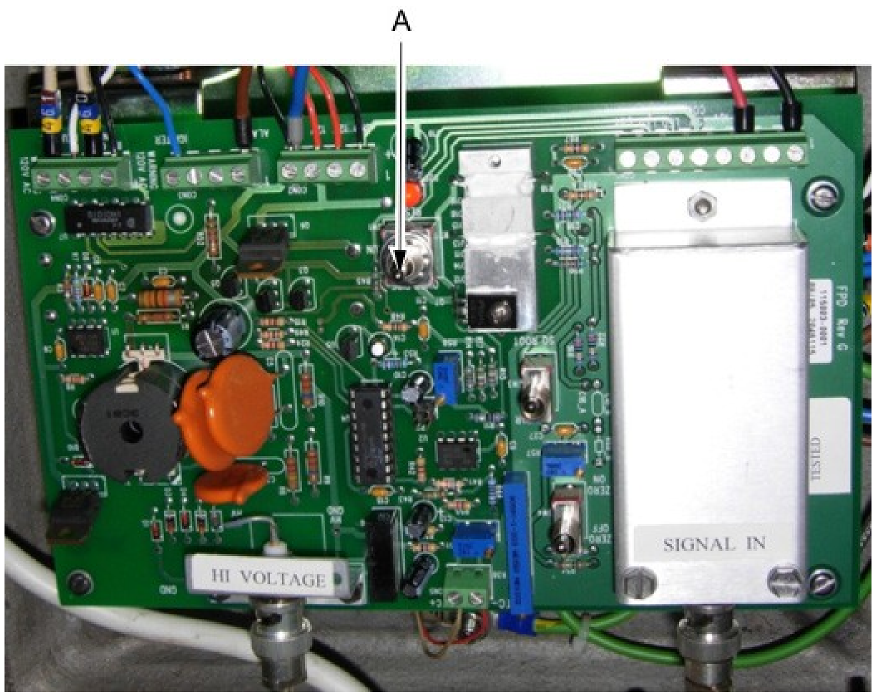
3.1 Operation

The FPD operates as a separate detector. It is controlled by and reports to the GC. The flow rates for the utility gases and the carrier gas are factory set, and are specific to each FPD. These should only be adjusted by fully trained and authorized personnel.

The FPD is identified as Detector #1 on the Detector screen, which is viewable with MON2000, MON2020, and the LOI. When used in conjunction with a TCD, the FPD is Detector #1, and the TCD is Detector #2.

NOTICE

The electrometer switch (A), which has three positions—up for *Reset*, centered for *Normal*, and down for *Override*—should not be left in *Override*.



A. Electrometer switch

3.1.1 Igniting the flame manually

1. Connect air to the inlet and slowly bring the inlet pressure to 60 psig.
2. Connect hydrogen to the inlet and slowly bring theinlet pressure to 60 psig.
3. Remove tubing from flame cell exhaust and use a digitalflow meter to adjust the air control valve until a reading of 160 cc/ min is obtained.
4. Turn off the air supply.
5. Set the auto relight switch (S1) on the electrometer PCB to the OVERRIDE position.
6. Use the digital flow meter to adjust the hydrogen controlvalve until a reading of 100 cc/min isobtained.
7. Turn on the air supply.
8. Set the auto relight switch (S1) on the electrometer PCB to the RUN position. The auto relight sequence starts as follows:
    a. The LED on the electrometer comes on after 10 seconds, and the glow plug fitted to the side of the flame cell is now supplied a voltage.
    b. After another 5 seconds, the hydrogen shut off valve operates.
    c. The gas mixture is ignited.
    d. If the flame does not light in 5 seconds, the electrometer de-energizes the hydrogen shut off valve to stop the flow into the flame cell.
    e. The flame cell is then purged with air and nitrogen carrier.
    f. The process starts again—up to 10times—until the flame stays lit.

g. If the flame does not stay lit, the LED flashes. If the alarm output is linked to the 2350A controllerdiscreet input, there will be an alarm present on the controller.

h. Set the auto relight switch (S1) on the electrometer PCB to the *RESET* position and then back to the *RUN* position. The re-light sequence isrestarted.

If the unit still fails to light after resetting the electrometer, recheck the air and hydrogen flows.

3.2 Maintenance

The FPD is a complex piece of equipment and needs to be regularly maintained, preferably as part of an annual planned maintenance process.

The following important maintenance procedures should be conducted on an annual basis:

- Replace the flame cell and photometric tube O-rings, except for the Kalrez O-ring, which should be replaced every 24months.

CAUTION

Be certain that the flame cell has cooled down before touching it, because it often reaches a temperature of 170 °C (338 °F).

- Lubricate the stem of the hydrogen shut-offvalve.

For both of these operations, the GC should be shut down, and the appropriate permits and permissions gained before commencing.

Only trained and authorized personnel should carry out maintenance..

NOTICE

The flame out logic should always be tested to ensure it works at the end of any maintenance.

Failure to maintain the FPD may cause a loss of functionality and can result in permanent damage to the equipment.

3.3 Troubleshooting

Only competent trained personnel should troubleshoot FPDs.

The following list of faults is not definitive. It only details the most common faults.

Fault symptom(s)	Possible solution(s)
When monitoring the baseline in MON2020, there are no upsets present when the auto re- light circuit fires. If no voltage, remove coax connector. If voltage is present, check signal coax.	• Check high voltage is present on coax. • Approx. -600 Vdc • If voltage now present on board, check coax cable. • Check BNC coax connectors are tight. • If there is no voltage, or the signal cable is OK, replace electrometer.
Upsets are being seen, but there are no peaks when gas is injected.	• Check the 12 V GND wiring to the electrometer board. The two GND terminals on connector #2 are not linked on board. If there are three black wires, ensure that pins 1 and 4 are connected to the power supply. The other wire is for the flame cell GND. • Check the tubing going into the bottom of the flame cell. Loosen fitting and pull tubing downwards while watching CGM. • If peaks appear, then the tubing needs to be cut. • Check to see if there is flow from the metering valve next to the heater block. • Check the sample is getting to the flame cell. • Try replacing the columns one at a time. • Check you are getting carrier through port 1 with valve 2 on and through port 5 with valve 2 off. If not check the vents on the Alcon valve for back pressure.

Fault symptom(s)	Possible solution(s)
Air and H_2 flows are set correctly, and the unit fails to stay lit.	• Using a digital thermometer connected to the thermocouple wires coming from the bottom of the flame-cell, check that the temperature is 160 °C (320 °F). • Check flame out thermocouple wires. • Ensure no insulation is trapped under screw on terminal strip. • Try pulling the sample tube out when it is attempting to light in case the tube is affecting the fuel mixture. • Replace the flame cell and try again. • Ensure that the signal wires are connected to the correct place; remember that the white signal wire should be connected to the TC+ of the CON5.
Unit give good size sample peaks; then after a while, the peaks are not present, but the relight still gives good peaks.	There might be soot on the sample tube going to the flame-cell. Pull tube down slightly while watching the CGM to see if that cures the fault.
Flame cell temperature cannot be controlled.	Check the flame cell thermistor. The resistance is approximately 100 KΩ at ambient. Resistance goes down as temperature goes up.
Flame cell temperature is erratic.	• Check that the thermistor has not been pushed right through the flame cell. • In later models, the flame cell will be *blanked* at end of holes to ensure that this cannot happen. • Check there is enough heat-sink compound fitted around sensors.
Unable to balance the bridge.	• Check the BNC connectors for the signal in and the high voltage. Ensure that they are tight. • Cut off the flame and check the response from the detector on a live CGM. • Try changing the filter.
Restrictor metering valve seems to be restricting the output flow completely.	• Apply Snoop® to the two fittings at the bottom of the metering valve. • Change the metering valve.
Peaks are very small or appear to be back to front.	• Check nitrogen flow into union at flame cell. • This should be no less than 15cc/min.

Fault symptom(s)	Possible solution(s)
Noisy baseline and/or very big dips on the baseline.	Check the air supply, which should be no lower than 500psi in the cylinder.

A Appendix A: Drawings

A.1 Model 500 FPD drawings

DUK 7233/013/1	General Arrangement: Model 500 FPD Module
DUK 7233/002/1	General Arrangement: Model 500 FPD Analyzer
DUK 7233/039/1	General Arrangement: Model 500 FPD Dual Analyzer
DUK 7233/028/1	Power Wiring Diagram: 500 FPD C/W Aux Stream Switching
DUK 7233/029/1	Wiring Diagram: FPD Relight Failure Alarm
DUK 7233/030/1	Power Wiring Diagram: Model 500 FPD
DUK 7233/033/1	Interconnection Diagram: 500 FPD / 2350A Controller
DUK 7233/034/1	Wiring Diagram: 500 FPD / 2350A Controller
DUK 7233/048/1	Wiring Diagram: 500 FPD / 2350A – 6 x 6 Port Valves
DUK 7233/056/1	Power Distribution : 500 FPD Dual Analyser C/W 2 x Trace Heat
DUK 7233/062/1	Wiring Diagram : 500 FPD / 2350A – 6 x 6 Port – Aux Stream Switching

NOTICE

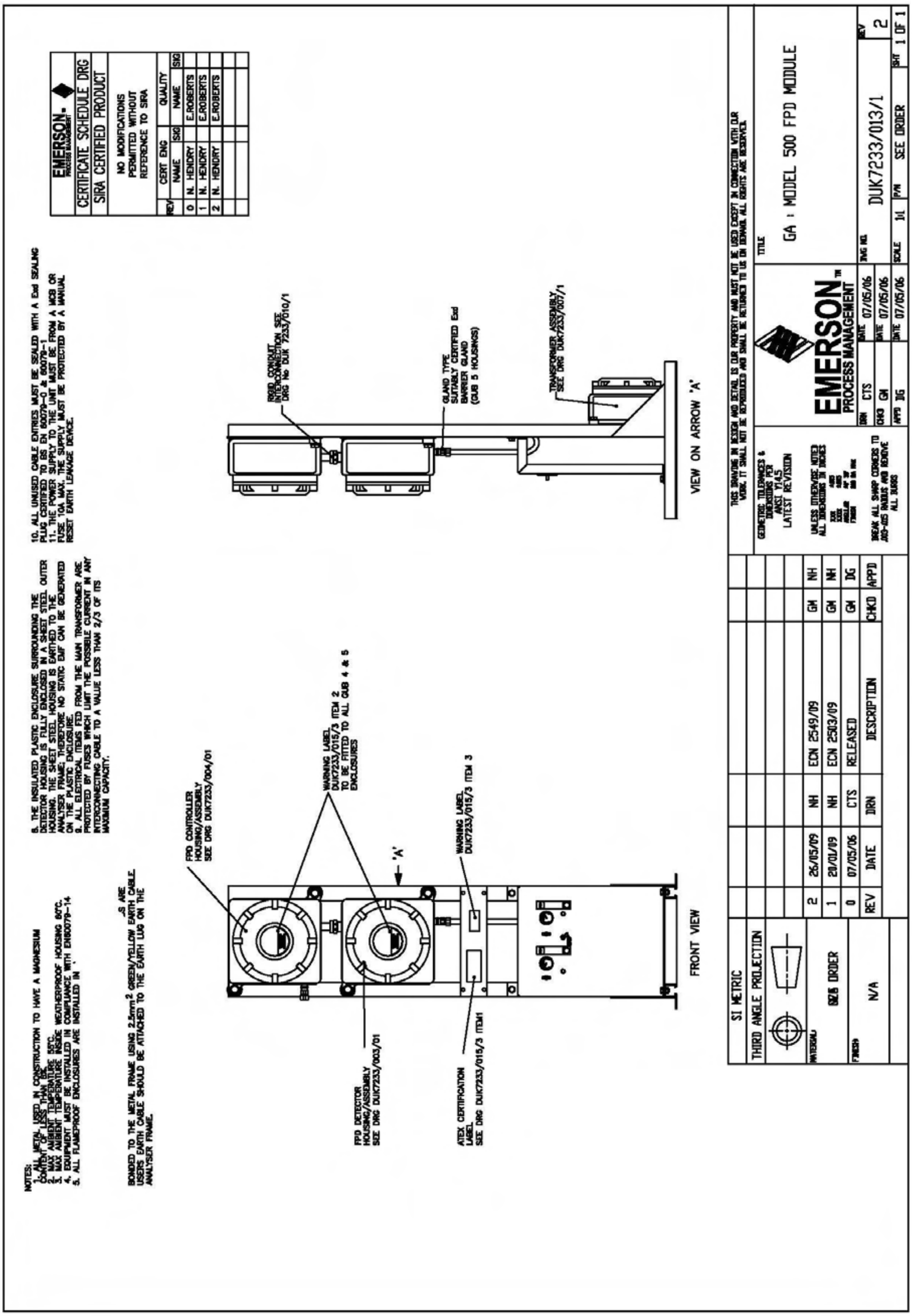
Flow Diagrams: Refer to the sales order documentation that was shipped with the GC.

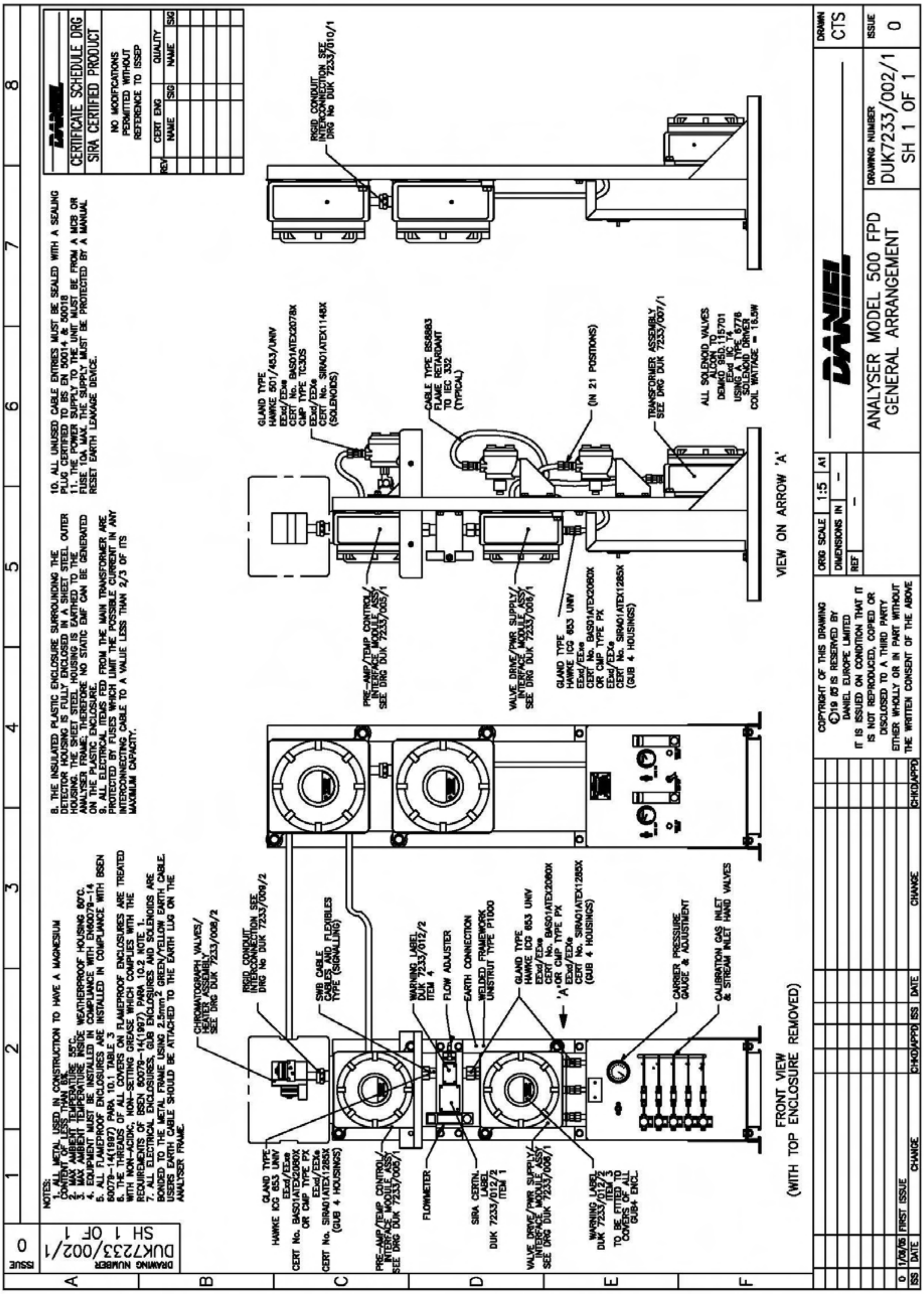
A.2 Model 700 FPD drawings

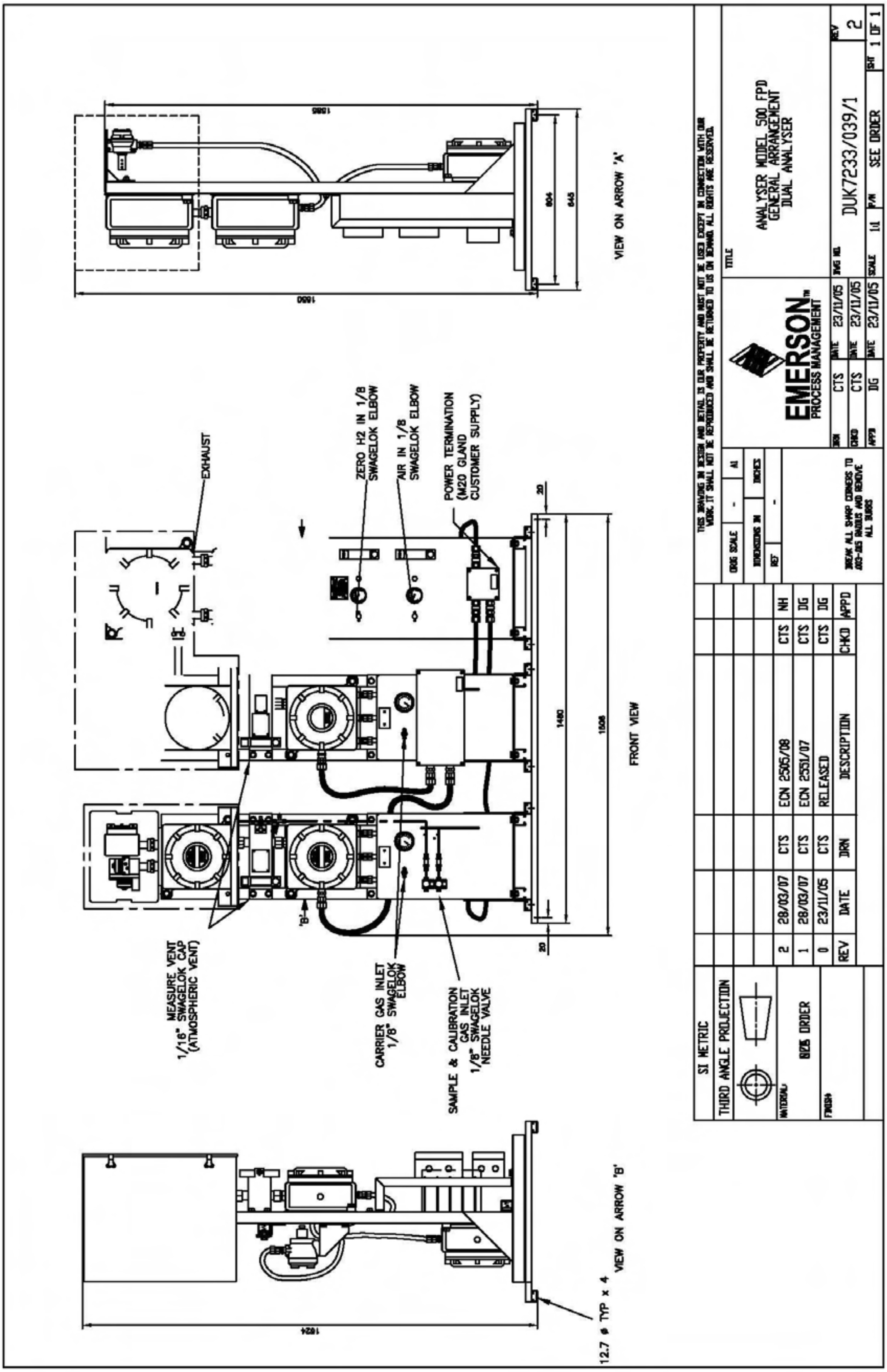
DUK 7204/074/1	General Arrangement: 700 FPD Analyzer
DUK 7204/100/1	General Arrangement: 700 FPD Module
DUK 7204/156/1	General Arrangement: 700 FPD Module Front Entry
DUK 7204/102/1	Internal Cable Wiring: 700 FPD Analyzer
DUK 7204/103/1	Power Wiring Diagram: 700 FPD Analyzer

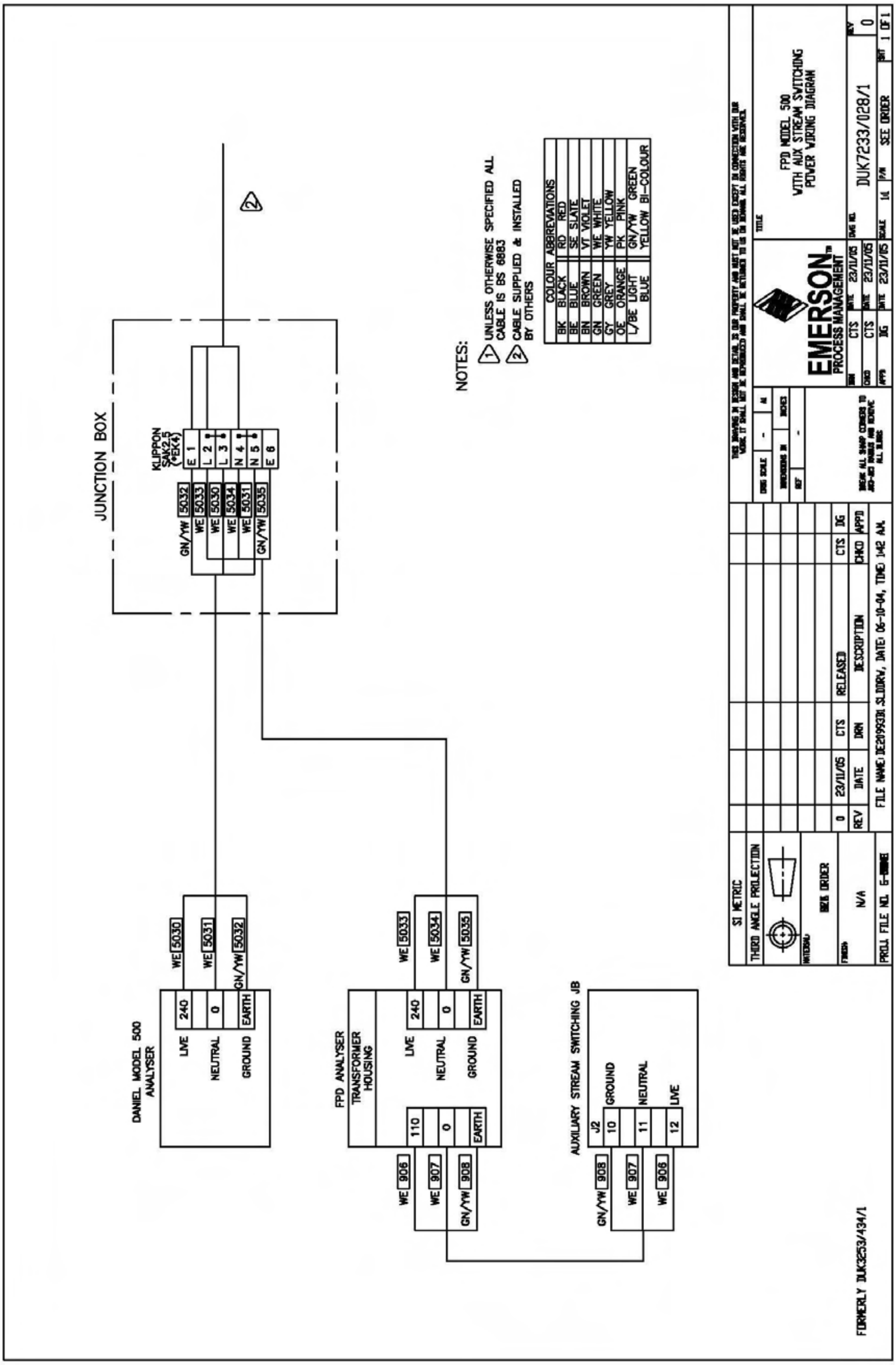
NOTICE

Flow Diagrams: Refer to the sales order documentation that was shipped with the GC.

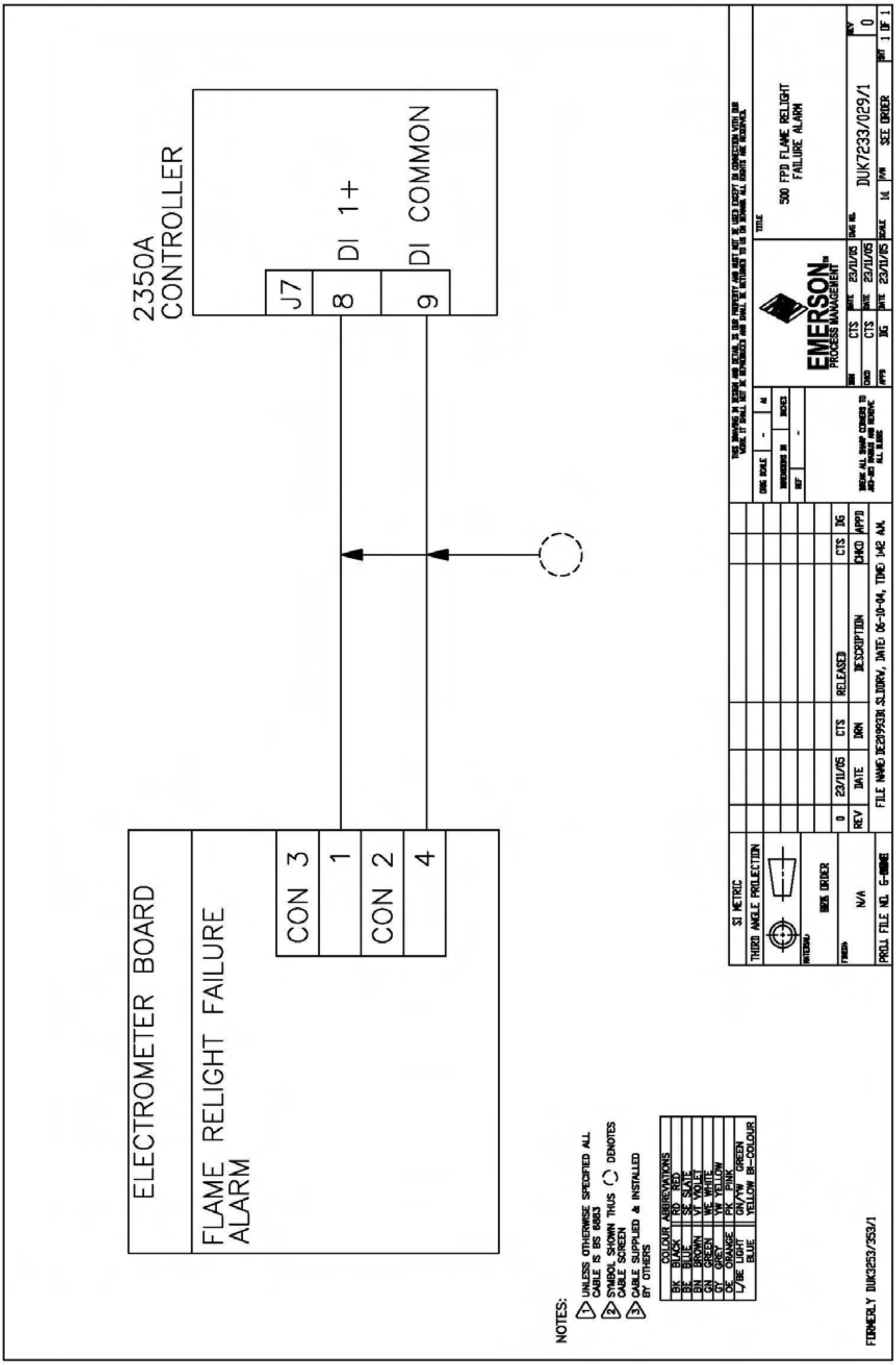

NOTES:
1. ALL METAL USED IN CONSTRUCTION TO HAVE A MAGNESIUM CONTENT OF LESS THAN 6%.
2. MAX AMBIENT TEMPERATURE 55°C.
3. MAX AMBIENT TEMPERATURE INSIDE WEATHERPROOF HOUSING 60°C.
4. EQUIPMENT MUST BE INSTALLED IN COMPLIANCE WITH EN60079-14
5. ALL FLAMEPROOF ENCLOSURES ARE INSTALLED IN
.S ARE BONDED TO THE METAL FRAME USING 2.5mm² GREEN/YELLOW EARTH CABLE. USERS EARTH CABLE SHOULD BE ATTACHED TO THE EARTH LUG ON THE ANALYSER FRAME.
8. THE INSULATED PLASTIC ENCLOSURE SURROUNDING THE DETECTOR HOUSING IS FULLY ENCLOSED IN A SHEET STEEL OUTER HOUSING. THE SHEET STEEL HOUSING IS EARTHED TO THE ANALYSER FRAME; THEREFORE NO STATIC EMF CAN BE GENERATED ON THE PLASTIC ENCLOSURE.
9. ALL ELECTRICAL ITEMS FED FROM THE MAIN TRANSFORMER ARE PROTECTED BY FUSES WHICH LIMIT THE POSSIBLE CURRENT IN ANY INTERCONNECTING CABLE TO A VALUE LESS THAN 2/3 OF ITS MAXIMUM CAPACITY.
10. ALL UNUSED CABLE ENTRIES MUST BE SEALED WITH A Exd SEALING PLUG CERTIFIED TO BS EN 60079-0 & 60079-1
11. THE POWER SUPPLY TO THE UNIT MUST BE FROM A MCB OR FUSE 10A MAX. THE SUPPLY MUST BE PROTECTED BY A MANUAL RESET EARTH LEAKAGE DEVICE.
EMERSON. PROCESS MANAGEMENT
CERTIFICATE SCHEDULE DRG
SIRA CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO SIRA
REV | CERT ENG NAME | SIG | QUALITY NAME | SIG
0 | N. HENDRY | | E.ROBERTS |
1 | N. HENDRY | | E.ROBERTS |
2 | N. HENDRY | | E.ROBERTS |
FPD CONTROLLER HOUSING/ASSEMBLY SEE DRG DUK7233/004/01
FPD DETECTOR HOUSING/ASSEMBLY SEE DRG DUK7233/003/01
WARNING LABEL DUK7233/015/3 ITEM 2 TO BE FITTED TO ALL GUB 4 & 5 ENCLOSURES
'A'
ATEX CERTIFICATION LABEL SEE DRG DUK7233/015/3 ITEM1
WARNING LABEL DUK7233/015/3 ITEM 3
FRONT VIEW
RIGID CONDUIT INTERCONNECTION SEE DRG No DUK 7233/010/1
GLAND TYPE SUITABLY CERTIFIED Exd BARRIER GLAND (GUB 5 HOUSINGS)
TRANSFORMER ASSEMBLY SEE DRG DUK7233/007/1
VIEW ON ARROW 'A'
SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: SEE ORDER
FINISH: N/A
REV | DATE | DRN | DESCRIPTION | CHKD | APPD
2 | 26/05/09 | NH | ECN 2549/09 | GM | NH
1 | 20/01/09 | NH | ECN 2503/09 | GM | NH
0 | 07/05/06 | CTS | RELEASED | GM | DG
THIS DRAWING IN DESIGN AND DETAIL IS OUR PROPERTY AND MUST NOT BE USED EXCEPT IN CONNECTION WITH OUR WORK. IT SHALL NOT BE REPRODUCED AND SHALL BE RETURNED TO US ON DEMAND. ALL RIGHTS ARE RESERVED.
GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION
UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS
EMERSON. PROCESS MANAGEMENT
DRN CTS DATE 07/05/06
CHKD GM DATE 07/05/06
APPD DG DATE 07/05/06
TITLE GA : MODEL 500 FPD MODULE
DWG NO. DUK7233/013/1
REV 2
SCALE 1:1
P/N SEE ORDER
SHT 1 OF 1

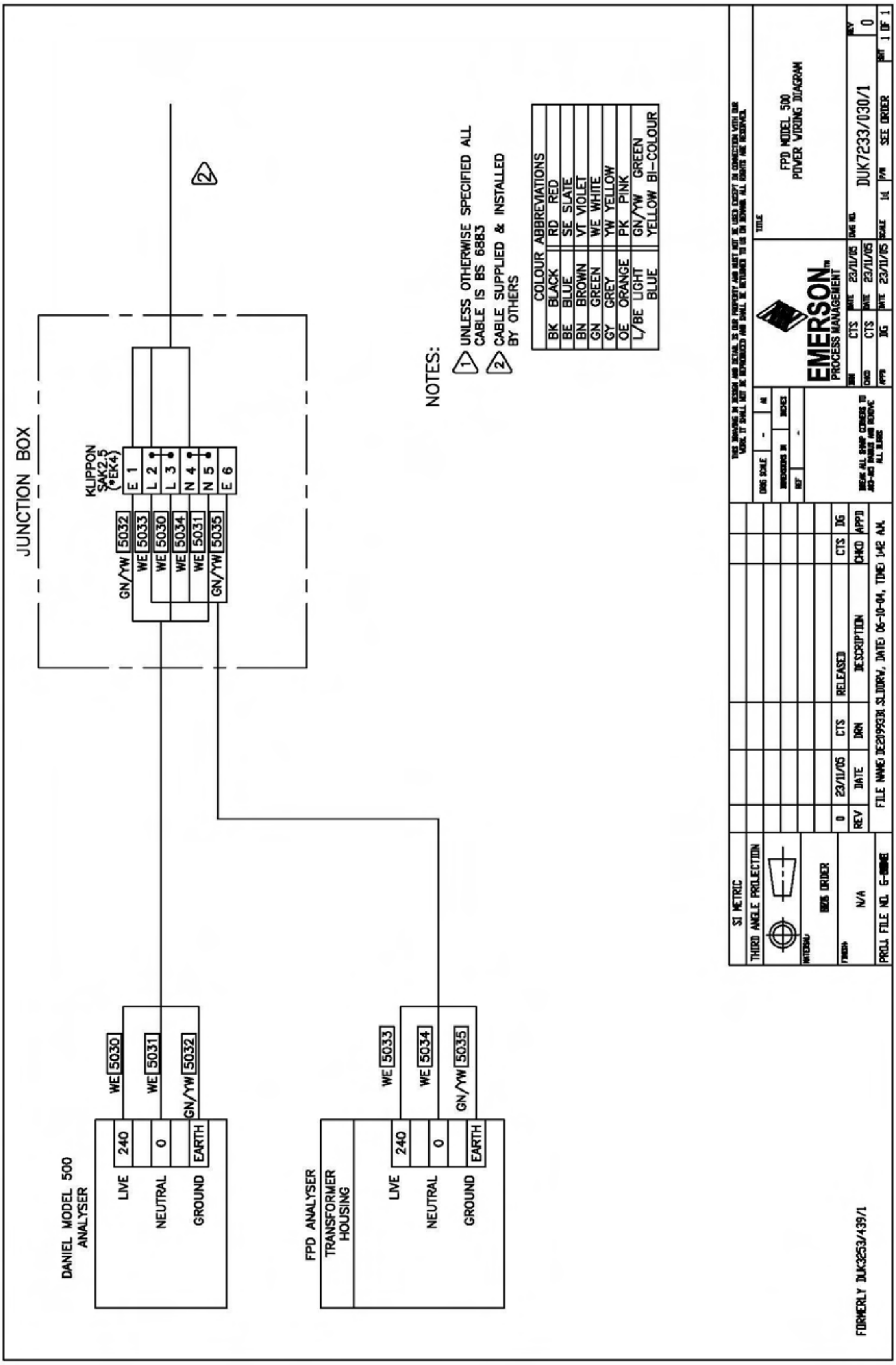

ANALYSER MODEL 500 FPD
GENERAL ARRANGEMENT
DUK7233/002/1
SH 1 OF 1
CERTIFICATE SCHEDULE DRG
SIRA CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO ISSEP
FRONT VIEW
(WITH TOP ENCLOSURE REMOVED)
VIEW ON ARROW 'A'

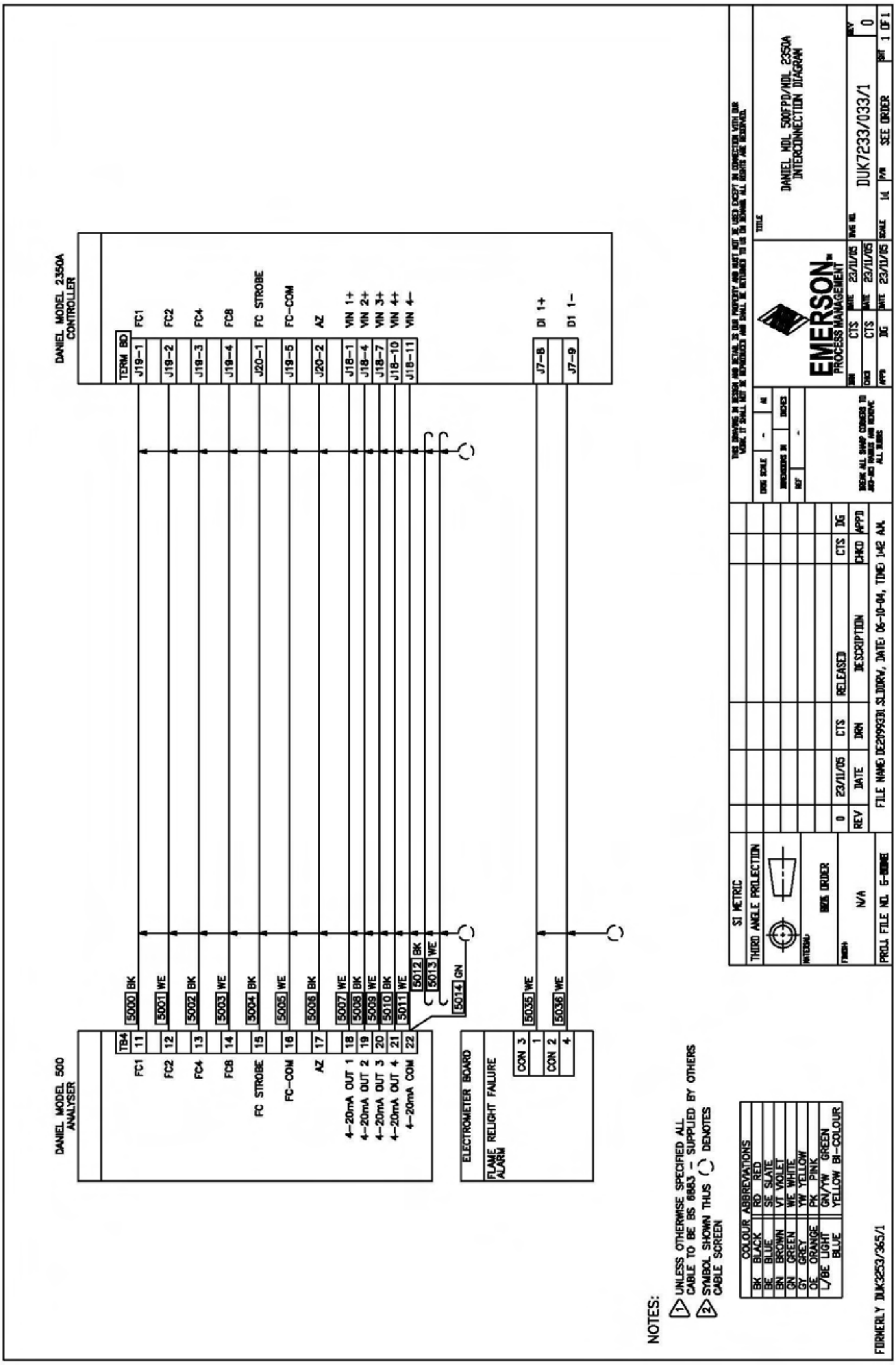

VIEW ON ARROW 'A'
1585
1550
604
645
EXHAUST
ZERO H2 IN 1/8 SWAGELOK ELBOW
AIR IN 1/8 SWAGELOK ELBOW
POWER TERMINATION (M20 GLAND CUSTOMER SUPPLY)
MEASURE VENT 1/16" SWAGELOK CAP (ATMOSPHERIC VENT)
CARRIER GAS INLET 1/8" SWAGELOK ELBOW
SAMPLE & CALIBRATION GAS INLET 1/8" SWAGELOK NEEDLE VALVE
'B'
20
1460
1508
FRONT VIEW
VIEW ON ARROW 'B'
12.7 ⌀ TYP x 4
1024
SI METRIC
THIRD ANGLE PROJECTION
MATERIAL
SEE ORDER
FINISH
2 28/03/07 CTS ECN 2505/08 CTS NH
1 28/03/07 CTS ECN 2551/07 CTS DG
0 23/11/05 CTS RELEASED CTS DG
REV DATE DRN DESCRIPTION CHKD APPD
THIS DRAWING IN DESIGN AND DETAIL IS OUR PROPERTY AND MUST NOT BE USED EXCEPT IN CONNECTION WITH OUR WORK. IT SHALL NOT BE REPRODUCED AND SHALL BE RETURNED TO US ON DEMAND. ALL RIGHTS ARE RESERVED.
ORIG SCALE - A1
DIMENSIONS IN INCHES
REF -
BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS
EMERSON PROCESS MANAGEMENT
TITLE
ANALYSER MODEL 500 FPD GENERAL ARRANGEMENT DUAL ANALYSER
DRN CTS DATE 23/11/05
CHKD CTS DATE 23/11/05
APPD DG DATE 23/11/05
DWG NO. DUK7233/039/1
REV 2
SCALE 1:1
P/N SEE ORDER
SHT 1 OF 1

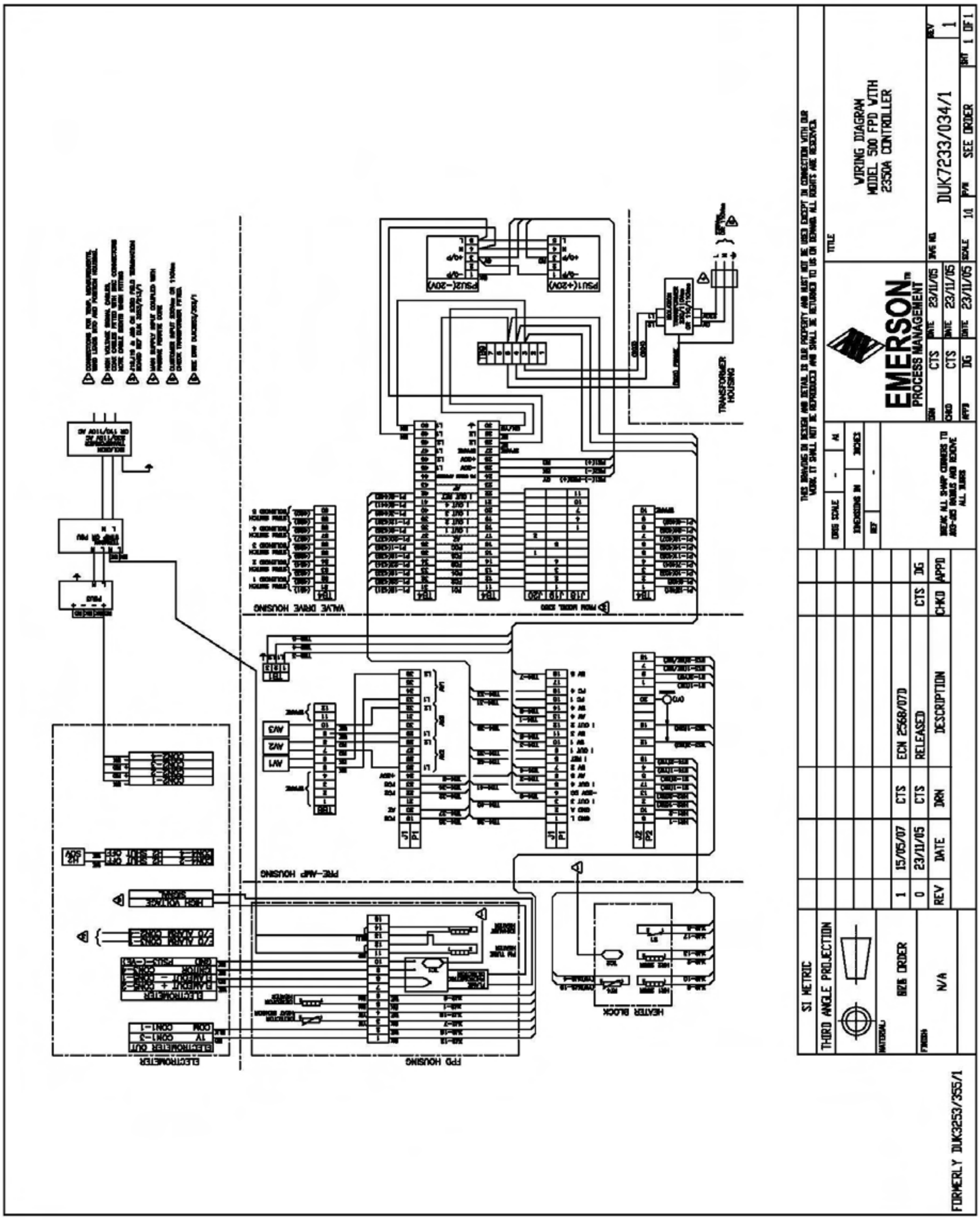


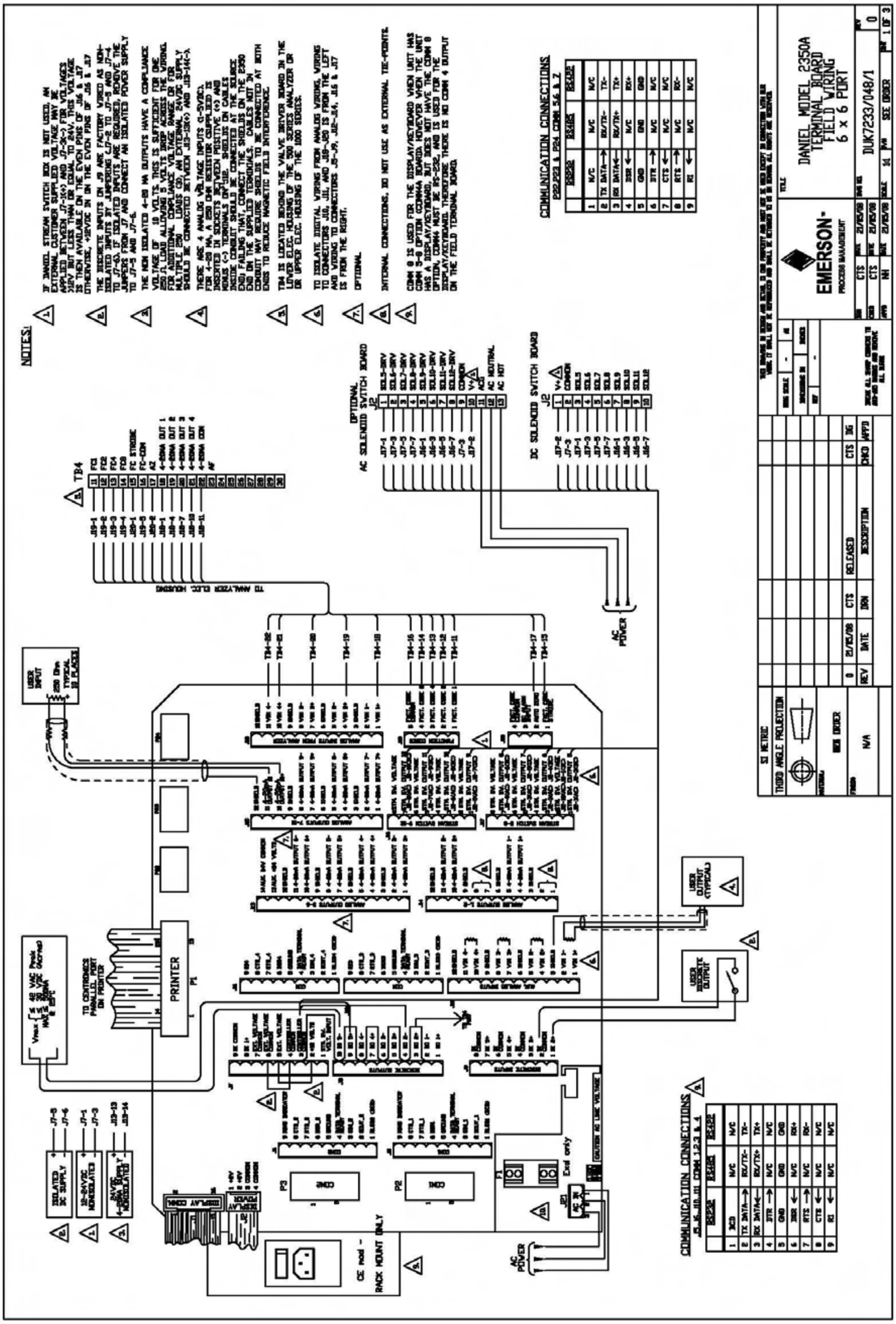
JUNCTION BOX
KLIPPON SAK2.5 (*EK4)
NOTES:
1 UNLESS OTHERWISE SPECIFIED ALL CABLE IS BS 6883
2 CABLE SUPPLIED & INSTALLED BY OTHERS
COLOUR ABBREVIATIONS
BK BLACK
BE BLUE
BN BROWN
GN GREEN
GY GREY
OE ORANGE
L/BE LIGHT BLUE
RD RED
SE SLATE
VT VIOLET
WE WHITE
YW YELLOW
PK PINK
GN/YW GREEN YELLOW BI-COLOUR
DANIEL MODEL 500 ANALYSER
LIVE
NEUTRAL
GROUND
EARTH
FPD ANALYSER TRANSFORMER HOUSING
AUXILIARY STREAM SWITCHING JB
FORMERLY DUK3253/434/1
SI METRIC
THIRD ANGLE PROJECTION
N/A
PRELL FILE NO.
REV
DATE
DRN
DESCRIPTION
CHKD
APPD
0
23/11/05
CTS
RELEASED
CTS
DG
FPD MODEL 500 WITH AUX STREAM SWITCHING POWER WIRING DIAGRAM
EMERSON PROCESS MANAGEMENT
DUK7233/028/1
SEE ORDER

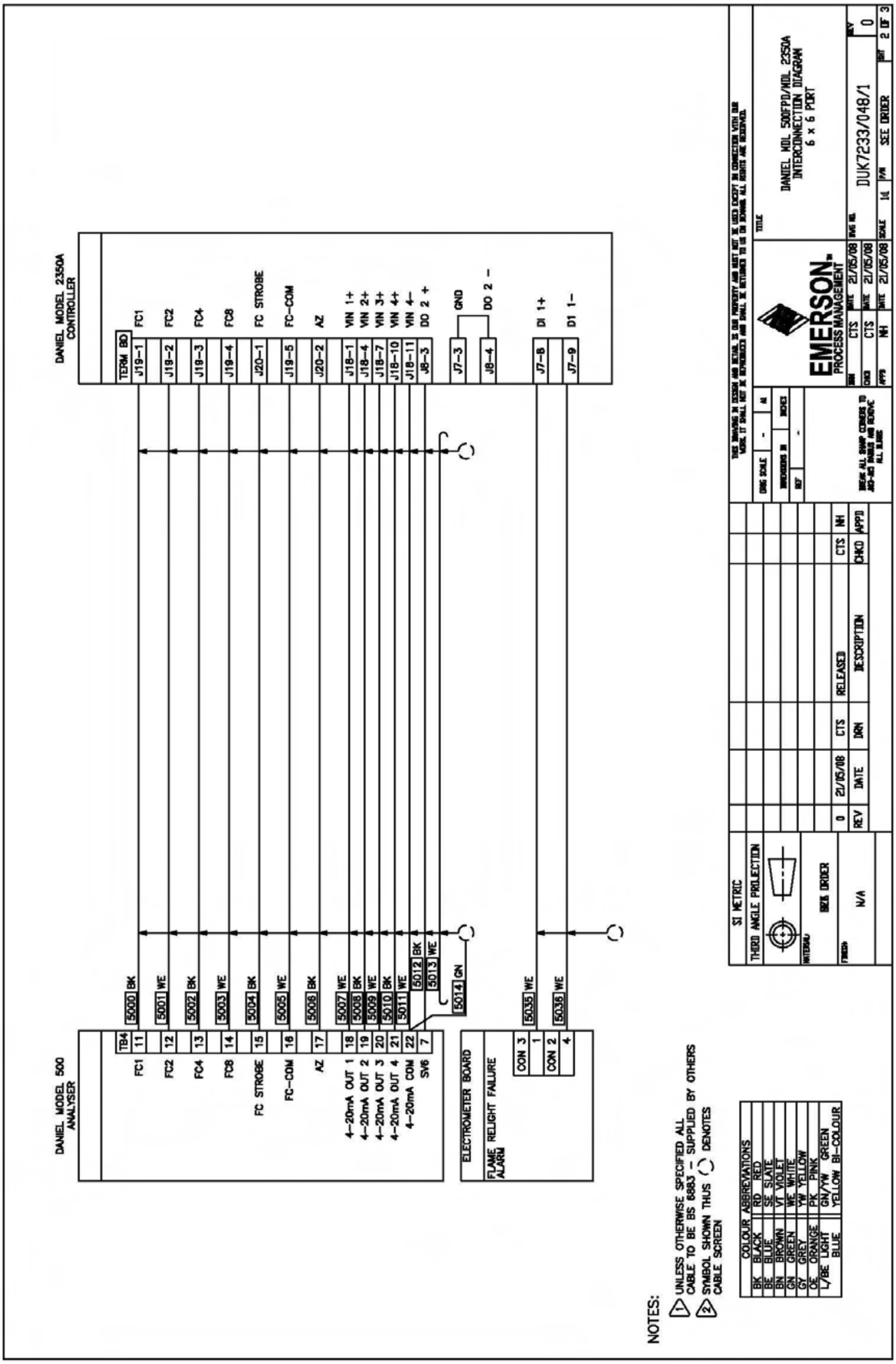

ELECTROMETER BOARD
FLAME RELIGHT FAILURE ALARM
CON 3
1
CON 2
4
2350A CONTROLLER
J7
8
DI 1+
9
DI COMMON
NOTES:
UNLESS OTHERWISE SPECIFIED ALL CABLE IS BS 6883
SYMBOL SHOWN THUS DENOTES CABLE SCREEN
CABLE SUPPLIED & INSTALLED BY OTHERS
COLOUR ABBREVIATIONS
BK BLACK
BE BLUE
BN BROWN
GN GREEN
GY GREY
OE ORANGE
L/BE LIGHT BLUE
RD RED
SE SLATE
VT VIOLET
WE WHITE
YW YELLOW
PK PINK
GN/YW GREEN YELLOW BI-COLOUR
FORMERLY DUK3253/353/1
SI METRIC
THIRD ANGLE PROJECTION
RELEASED
DESCRIPTION
EMERSON PROCESS MANAGEMENT
500 FPD FLAME RELIGHT FAILURE ALARM
DUK7233/029/1
SEE ORDER

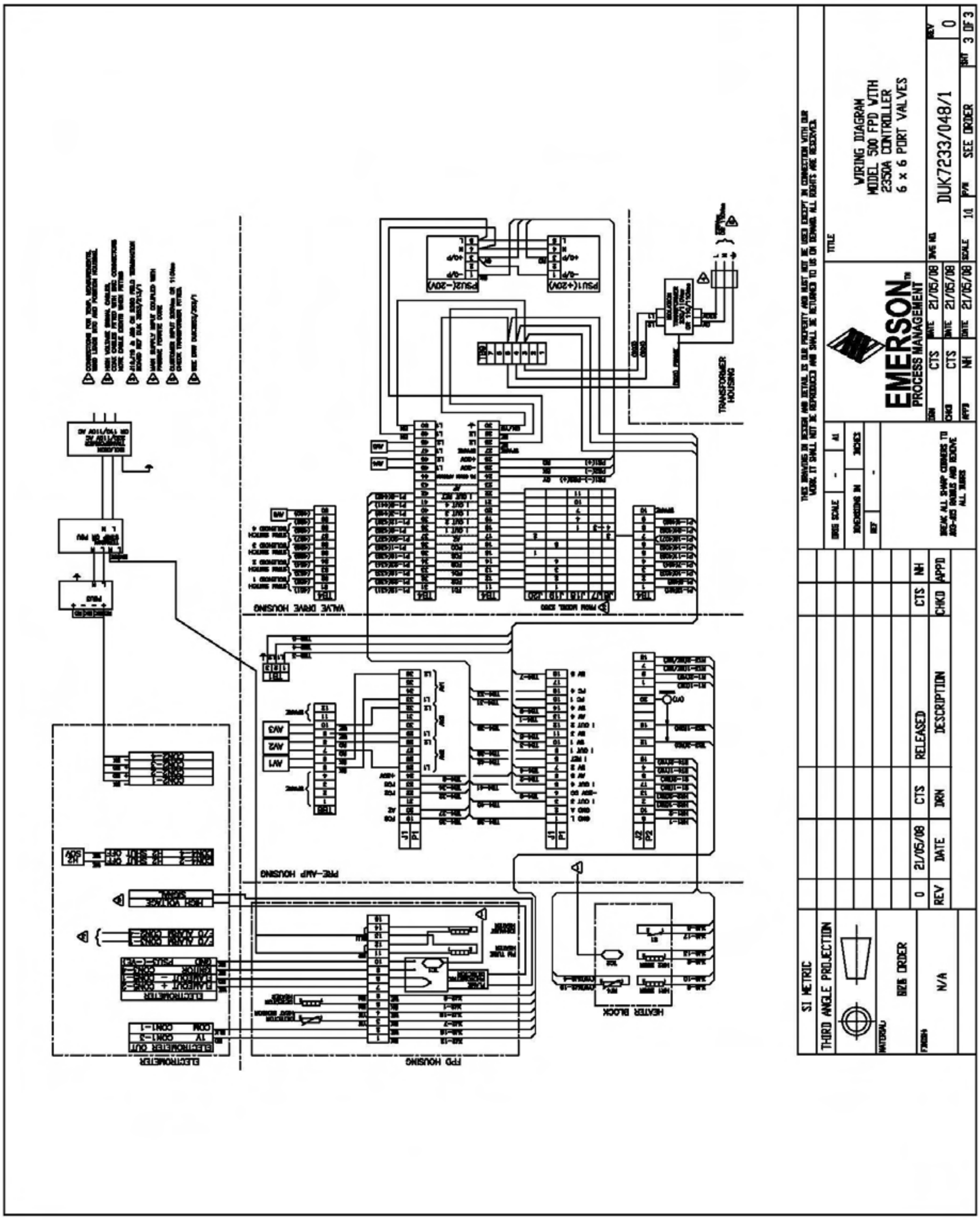

JUNCTION BOX
KLIPPON
SAK2.5
(*EK4)
E 1
L 2
L 3
N 4
N 5
E 6
GN/YW 5032
WE 5033
WE 5030
WE 5034
WE 5031
GN/YW 5035
NOTES:
1 UNLESS OTHERWISE SPECIFIED ALL CABLE IS BS 6883
2 CABLE SUPPLIED & INSTALLED BY OTHERS
COLOUR ABBREVIATIONS
BK BLACK
BE BLUE
BN BROWN
GN GREEN
GY GREY
OE ORANGE
L/BE LIGHT BLUE
RD RED
SE SLATE
VT VIOLET
WE WHITE
YW YELLOW
PK PINK
GN/YW GREEN YELLOW BI-COLOUR
DANIEL MODEL 500 ANALYSER
LIVE
NEUTRAL
GROUND
240
0
EARTH
WE 5030
WE 5031
GN/YW 5032
FPD ANALYSER
TRANSFORMER HOUSING
LIVE
NEUTRAL
GROUND
240
0
EARTH
WE 5033
WE 5034
GN/YW 5035
FORMERLY DUK3253/439/1
SI METRIC
THIRD ANGLE PROJECTION
N/A
0
23/11/05
CTS
RELEASED
CTS
DG
REV
DATE
DRN
DESCRIPTION
CHKD
APPD
EMERSON
PROCESS MANAGEMENT
FPD MODEL 500
POWER WIRING DIAGRAM
DUK7233/030/1
SEE ORDER
1 OF 1

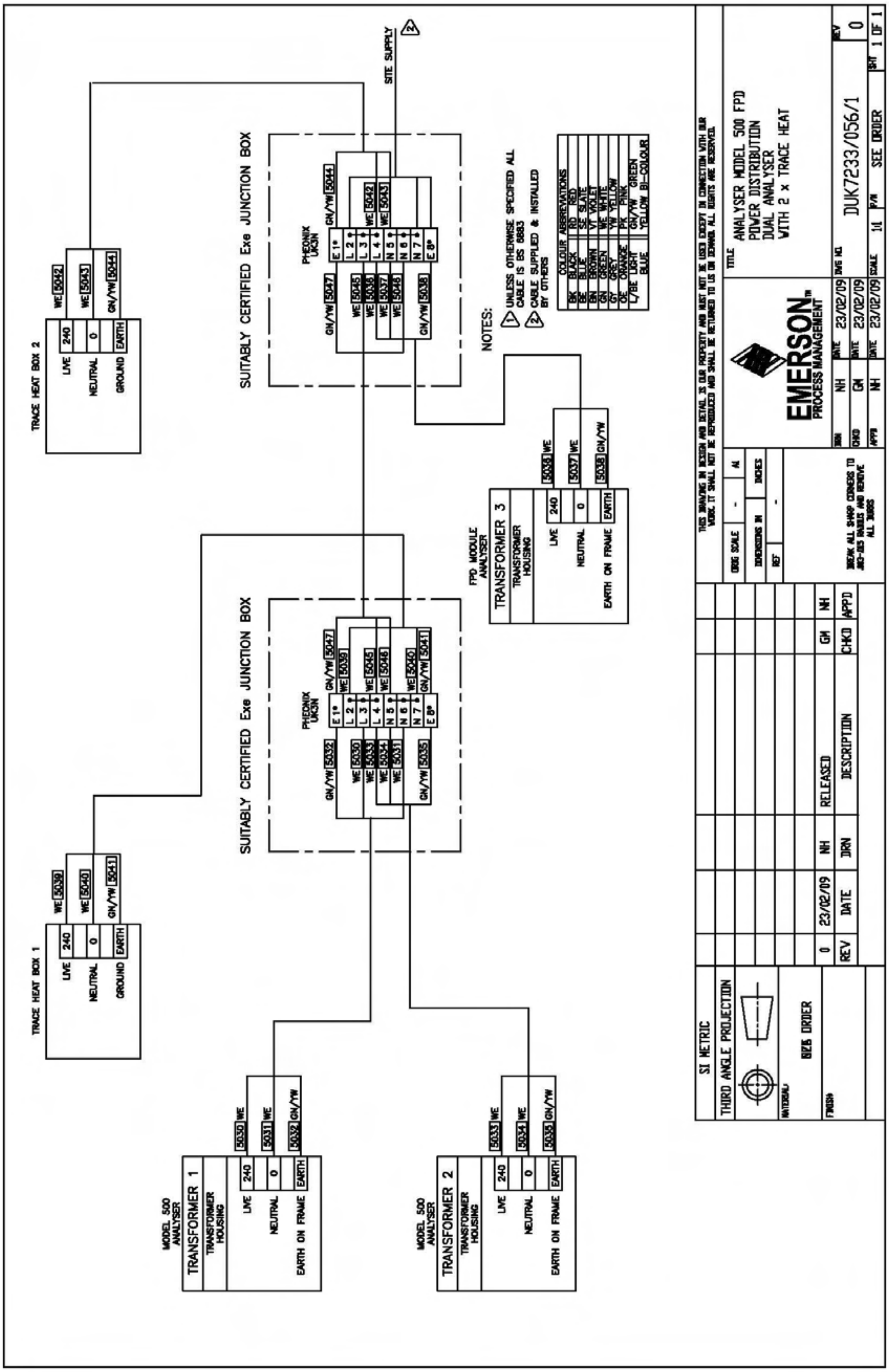

DANIEL MODEL 500 ANALYSER
DANIEL MODEL 2350A CONTROLLER
TB4
TERM BD
FC1
FC2
FC4
FC8
FC STROBE
FC-COM
AZ
4-20mA OUT 1
4-20mA OUT 2
4-20mA OUT 3
4-20mA OUT 4
4-20mA COM
VIN 1+
VIN 2+
VIN 3+
VIN 4+
VIN 4-
DI 1+
D1 1-
ELECTROMETER BOARD
FLAME RELIGHT FAILURE ALARM
CON 3
CON 2
NOTES:
UNLESS OTHERWISE SPECIFIED ALL CABLE TO BE BS 6883 - SUPPLIED BY OTHERS
SYMBOL SHOWN THUS DENOTES CABLE SCREEN
COLOUR ABBREVIATIONS
BK BLACK
BE BLUE
BN BROWN
GN GREEN
GY GREY
OE ORANGE
L/BE LIGHT BLUE
RD RED
SE SLATE
VT VIOLET
WE WHITE
YW YELLOW
PK PINK
GN/YW GREEN YELLOW BI-COLOUR
FORMERLY DUK3253/365/1
SI METRIC
THIRD ANGLE PROJECTION
N/A
RELEASED
DESCRIPTION
FILE NAME
EMERSON
PROCESS MANAGEMENT
DANIEL MDL 500FPD/MDL 2350A INTERCONNECTION DIAGRAM
DUK7233/033/1
SEE ORDER

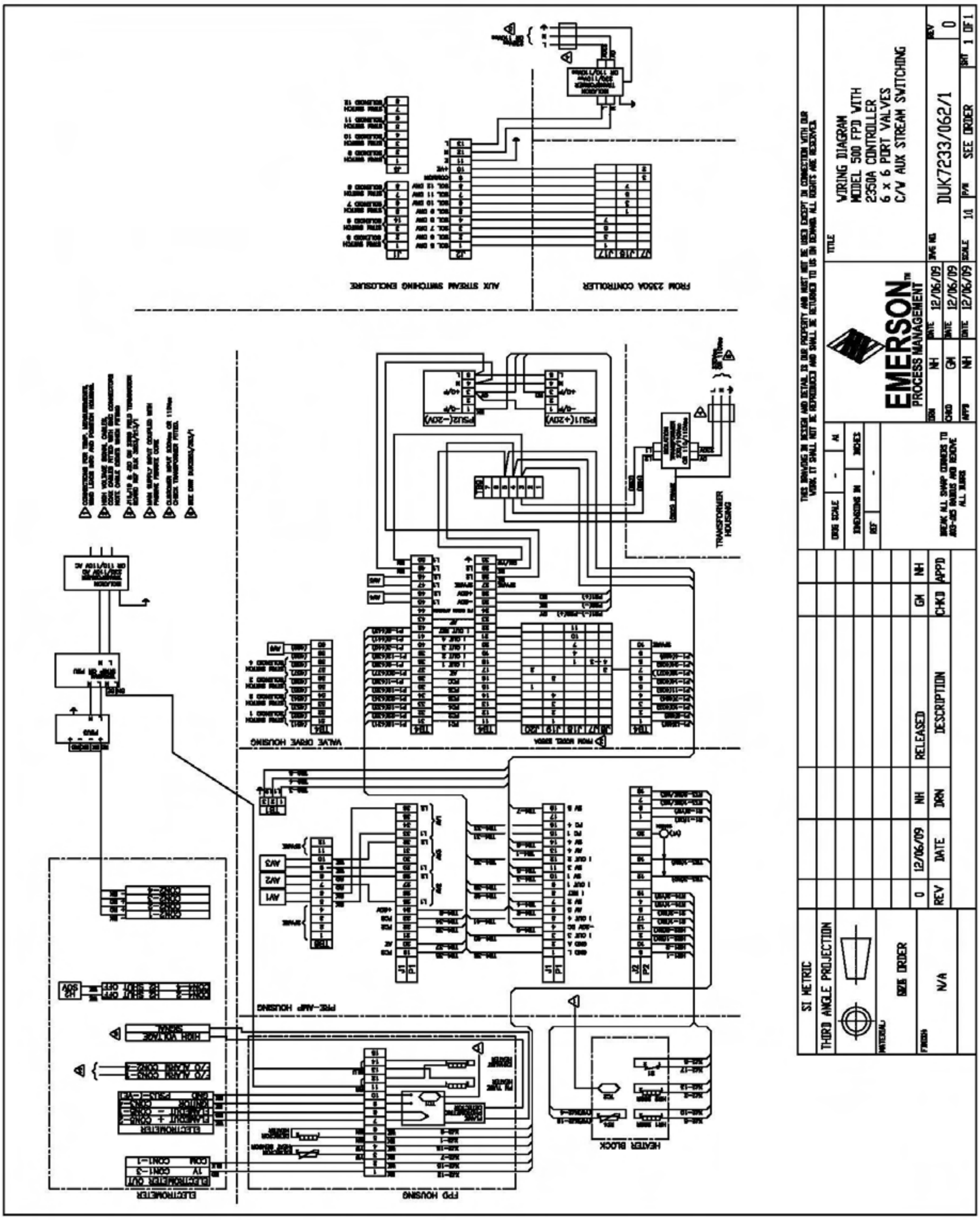

VIRING DIAGRAM
MODEL 500 FPD WITH
2350A CONTROLLER
DUK7233/034/1
EMERSON
PROCESS MANAGEMENT
FORMERLY DUK3253/355/1
SI METRIC
THIRD ANGLE PROJECTION
FPD HOUSING
PRE-AMP HOUSING
VALVE DRIVE HOUSING
HEATER BLOCK
TRANSFORMER HOUSING
ELECTROMETER

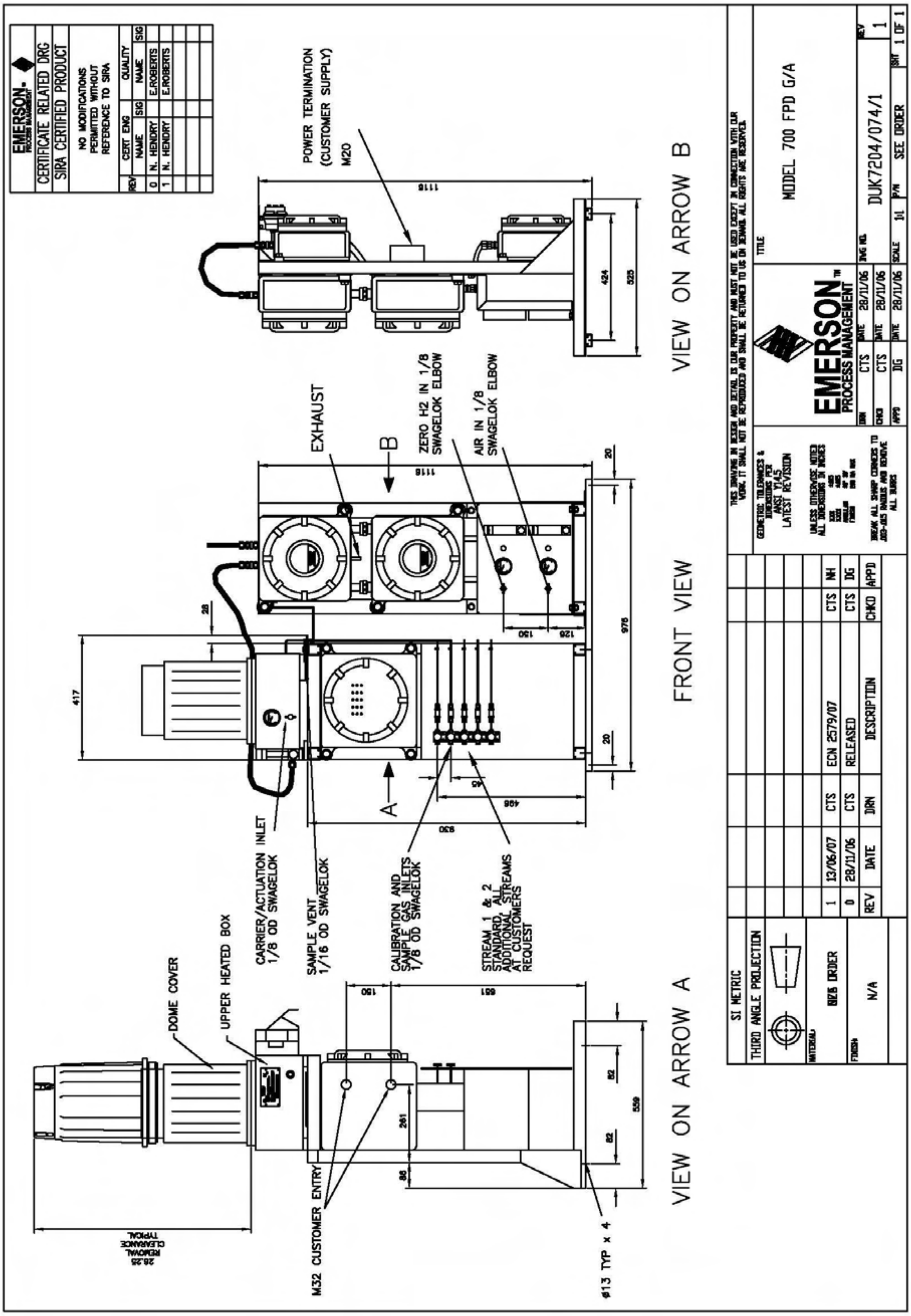

EMERSON
PROCESS MANAGEMENT
DANIEL MODEL 2350A
TERMINAL BOARD
FIELD WIRING
6 x 6 PORT
DUK7233/048/1

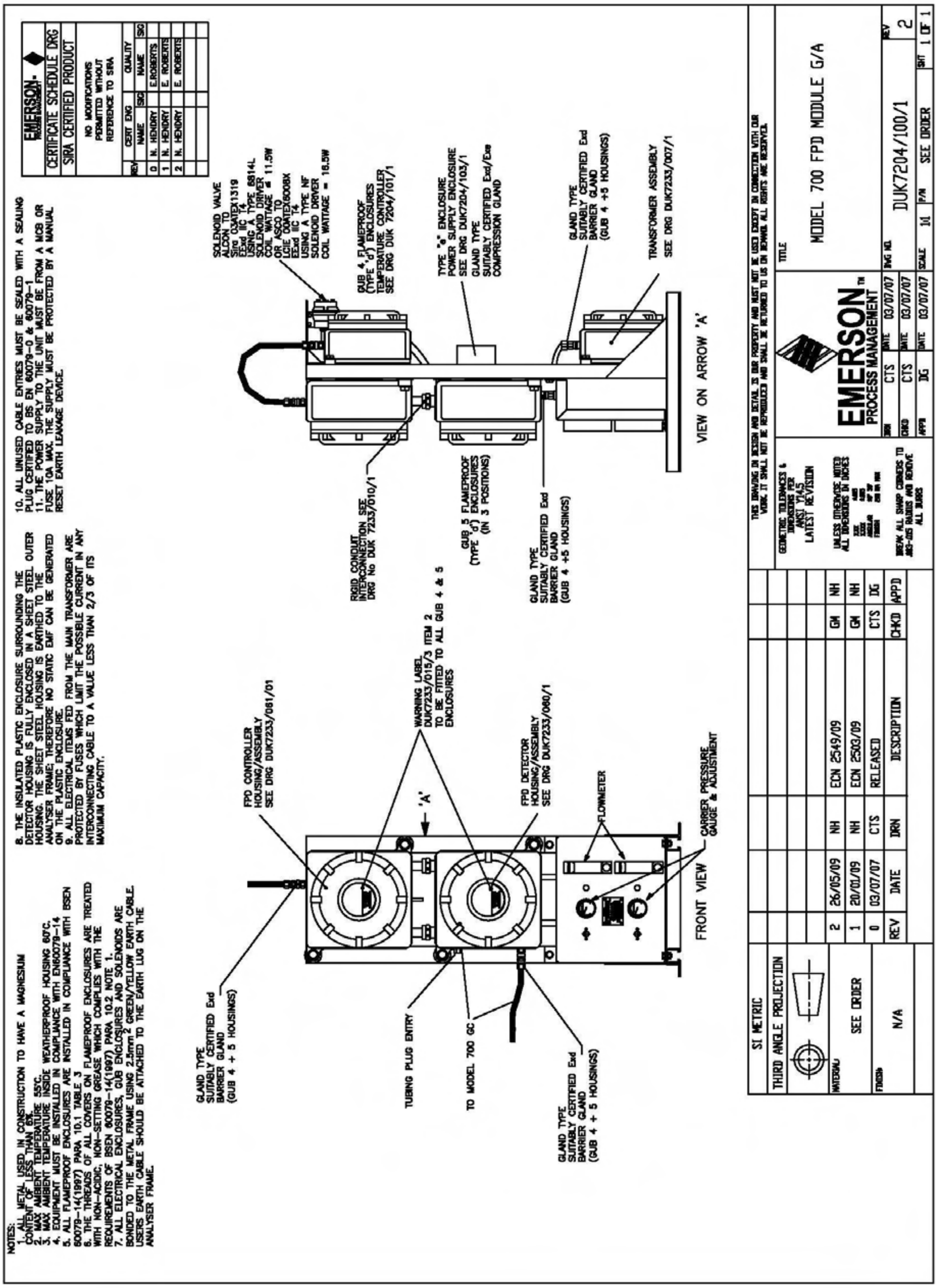

DANIEL MODEL 500 ANALYSER
DANIEL MODEL 2350A CONTROLLER
TERM BD
FC1
FC2
FC4
FC8
FC STROBE
FC-COM
AZ
VIN 1+
VIN 2+
VIN 3+
VIN 4+
VIN 4-
DO 2 +
GND
DO 2 -
DI 1+
D1 1-
4-20mA OUT 1
4-20mA OUT 2
4-20mA OUT 3
4-20mA OUT 4
4-20mA COM
SV6
ELECTROMETER BOARD
FLAME RELIGHT FAILURE ALARM
NOTES:
UNLESS OTHERWISE SPECIFIED ALL CABLE TO BE BS 6883 - SUPPLIED BY OTHERS
SYMBOL SHOWN THUS DENOTES CABLE SCREEN
COLOUR ABBREVIATIONS
BK BLACK
BE BLUE
BN BROWN
GN GREEN
GY GREY
OE ORANGE
L/BE LIGHT BLUE
RD RED
SE SLATE
VT VIOLET
WE WHITE
YW YELLOW
PK PINK
GN/YW GREEN YELLOW BI-COLOUR
SI METRIC
THIRD ANGLE PROJECTION
0
21/05/08
CTS
RELEASED
CTS
NH
REV
DATE
DRN
DESCRIPTION
CHKD
APPD
EMERSON
PROCESS MANAGEMENT
DANIEL MDL 500FPD/MDL 2350A INTERCONNECTION DIAGRAM 6 x 6 PORT
DUK7233/048/1
SEE ORDER
2 OF 3


WIRING DIAGRAM
MODEL 500 FPD WITH
2350A CONTROLLER
6 x 6 PORT VALVES
DUK7233/048/1
EMERSON
PROCESS MANAGEMENT
SEE ORDER
SI METRIC
THIRD ANGLE PROJECTION
RELEASED
DESCRIPTION
21/05/08
HEATER BLOCK
FPD HOUSING
ELECTROMETER
PRE-AMP HOUSING
VALVE DRIVE HOUSING
TRANSFORMER HOUSING


TRACE HEAT BOX 1
TRACE HEAT BOX 2
SUITABLY CERTIFIED Exe JUNCTION BOX
SUITABLY CERTIFIED Exe JUNCTION BOX
SITE SUPPLY
MODEL 500 ANALYSER TRANSFORMER 1 TRANSFORMER HOUSING
MODEL 500 ANALYSER TRANSFORMER 2 TRANSFORMER HOUSING
FPD MODULE ANALYSER TRANSFORMER 3 TRANSFORMER HOUSING
LIVE
NEUTRAL
EARTH ON FRAME
NOTES:
UNLESS OTHERWISE SPECIFIED ALL CABLE IS BS 6883
CABLE SUPPLIED & INSTALLED BY OTHERS
COLOUR ABBREVIATIONS
ANALYSER MODEL 500 FPD
POWER DISTRIBUTION
DUAL ANALYSER
WITH 2 x TRACE HEAT
EMERSON PROCESS MANAGEMENT
DUK7233/056/1
SI METRIC
THIRD ANGLE PROJECTION
RELEASED
DESCRIPTION


WIRING DIAGRAM
MODEL 500 FPD WITH
2350A CONTROLLER
6 x 6 PORT VALVES
C/V AUX STREAM SWITCHING
DUK7233/062/1
EMERSON
PROCESS MANAGEMENT
SI METRIC
THIRD ANGLE PROJECTION
RELEASED
12/06/09


EMERSON PROCESS MANAGEMENT
CERTIFICATE RELATED DRG
SIRA CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO SIRA
REV CERT ENG NAME SIG QUALITY NAME SIG
0 N. HENDRY E.ROBERTS
1 N. HENDRY E.ROBERTS
POWER TERMINATION (CUSTOMER SUPPLY) M20
VIEW ON ARROW B
EXHAUST
ZERO H2 IN 1/8 SWAGELOK ELBOW
AIR IN 1/8 SWAGELOK ELBOW
FRONT VIEW
DOME COVER
UPPER HEATED BOX
CARRIER/ACTUATION INLET 1/8 OD SWAGELOK
SAMPLE VENT 1/16 OD SWAGELOK
CALIBRATION AND SAMPLE GAS INLETS 1/8 OD SWAGELOK
STREAM 1 & 2 STANDARD, ALL ADDITIONAL STREAMS AT CUSTOMERS REQUEST
VIEW ON ARROW A
M32 CUSTOMER ENTRY
Ø13 TYP x 4
SI METRIC
THIRD ANGLE PROJECTION
SEE ORDER
N/A
1 13/06/07 CTS ECN 2579/07 CTS NH
0 28/11/06 CTS RELEASED CTS DG
REV DATE DRN DESCRIPTION CHKD APPD
GEOMETRIC TOLERANCES & DIMENSIONING PER ANSI Y14.5 LATEST REVISION
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS
TITLE
MODEL 700 FPD G/A
DRN CTS DATE 28/11/06
CHKD CTS DATE 28/11/06
APPD DG DATE 28/11/06
DWG NO. DUK7204/074/1
REV 1
SCALE 1:1 P/N SEE ORDER SHT 1 OF 1


NOTES:
1. ALL METAL USED IN CONSTRUCTION TO HAVE A MAGNESIUM CONTENT OF LESS THAN 6%.
2. MAX AMBIENT TEMPERATURE 55°C.
3. MAX AMBIENT TEMPERATURE INSIDE WEATHERPROOF HOUSING 60°C.
4. EQUIPMENT MUST BE INSTALLED IN COMPLIANCE WITH EN60079-14
5. ALL FLAMEPROOF ENCLOSURES ARE INSTALLED IN COMPLIANCE WITH BSEN 60079-14(1997) PARA 10.1 TABLE 3
6. THE THREADS OF ALL COVERS ON FLAMEPROOF ENCLOSURES ARE TREATED WITH NON-ACIDIC, NON-SETTING GREASE WHICH COMPLIES WITH THE REQUIREMENTS OF BSEN 60079-14(1997) PARA 10.2 NOTE 1.
7. ALL ELECTRICAL ENCLOSURES, GUB ENCLOSURES AND SOLENOIDS ARE BONDED TO THE METAL FRAME USING 2.5mm² GREEN/YELLOW EARTH CABLE. USERS EARTH CABLE SHOULD BE ATTACHED TO THE EARTH LUG ON THE ANALYSER FRAME.
8. THE INSULATED PLASTIC ENCLOSURE SURROUNDING THE DETECTOR HOUSING IS FULLY ENCLOSED IN A SHEET STEEL OUTER HOUSING. THE SHEET STEEL HOUSING IS EARTHED TO THE ANALYSER FRAME; THEREFORE NO STATIC EMF CAN BE GENERATED ON THE PLASTIC ENCLOSURE.
9. ALL ELECTRICAL ITEMS FED FROM THE MAIN TRANSFORMER ARE PROTECTED BY FUSES WHICH LIMIT THE POSSIBLE CURRENT IN ANY INTERCONNECTING CABLE TO A VALUE LESS THAN 2/3 OF ITS MAXIMUM CAPACITY.
10. ALL UNUSED CABLE ENTRIES MUST BE SEALED WITH A SEALING PLUG CERTIFIED TO BS EN 60079-0 & 60079-1
11. THE POWER SUPPLY TO THE UNIT MUST BE FROM A MCB OR FUSE 10A MAX. THE SUPPLY MUST BE PROTECTED BY A MANUAL RESET EARTH LEAKAGE DEVICE.
EMERSON.
CERTIFICATE SCHEDULE DRG
SIRA CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO SIRA
REV | CERT ENG NAME | SIG | QUALITY NAME | SIG
0 | N. HENDRY | | E.ROBERTS |
1 | N. HENDRY | | E. ROBERTS |
2 | N. HENDRY | | E. ROBERTS |
GLAND TYPE SUITABLY CERTIFIED Exd BARRIER GLAND (GUB 4 + 5 HOUSINGS)
FPD CONTROLLER HOUSING/ASSEMBLY SEE DRG DUK7233/061/01
TUBING PLUG ENTRY
'A'
WARNING LABEL DUK7233/015/3 ITEM 2 TO BE FITTED TO ALL GUB 4 & 5 ENCLOSURES
TO MODEL 700 GC
FPD DETECTOR HOUSING/ASSEMBLY SEE DRG DUK7233/060/1
FLOWMETER
FRONT VIEW
CARRIER PRESSURE GAUGE & ADJUSTMENT
SOLENOID VALVE ALCON TO Sira 03ATEX1319 EExd IIC T4 USING A TYPE 6814L SOLENOID DRIVER COIL WATTAGE = 11.5W OR ASCO TO LCIE 00ATEX6008X EExd IIC T4 USING A TYPE NF SOLENOID DRIVER COIL WATTAGE = 16.5W
RIGID CONDUIT INTERCONNECTION SEE DRG No DUK 7233/010/1
GUB 4 FLAMEPROOF (TYPE 'd') ENCLOSURES TEMPERATURE CONTROLLER SEE DRG DUK 7204/101/1
TYPE "e" ENCLOSURE POWER SUPPLY ENCLOSURE SEE DRG DUK7204/103/1 GLAND TYPE SUITABLY CERTIFIED Exd/Exe COMPRESSION GLAND
GUB 5 FLAMEPROOF (TYPE 'd') ENCLOSURES (IN 3 POSITIONS)
GLAND TYPE SUITABLY CERTIFIED Exd BARRIER GLAND (GUB 4 +5 HOUSINGS)
TRANSFORMER ASSEMBLY SEE DRG DUK7233/007/1
VIEW ON ARROW 'A'
SI METRIC
THIRD ANGLE PROJECTION
MATERIAL SEE ORDER
FINISH N/A
REV | DATE | DRN | DESCRIPTION | CHKD | APPD
2 | 26/05/09 | NH | ECN 2549/09 | GM | NH
1 | 20/01/09 | NH | ECN 2503/09 | GM | NH
0 | 03/07/07 | CTS | RELEASED | CTS | DG
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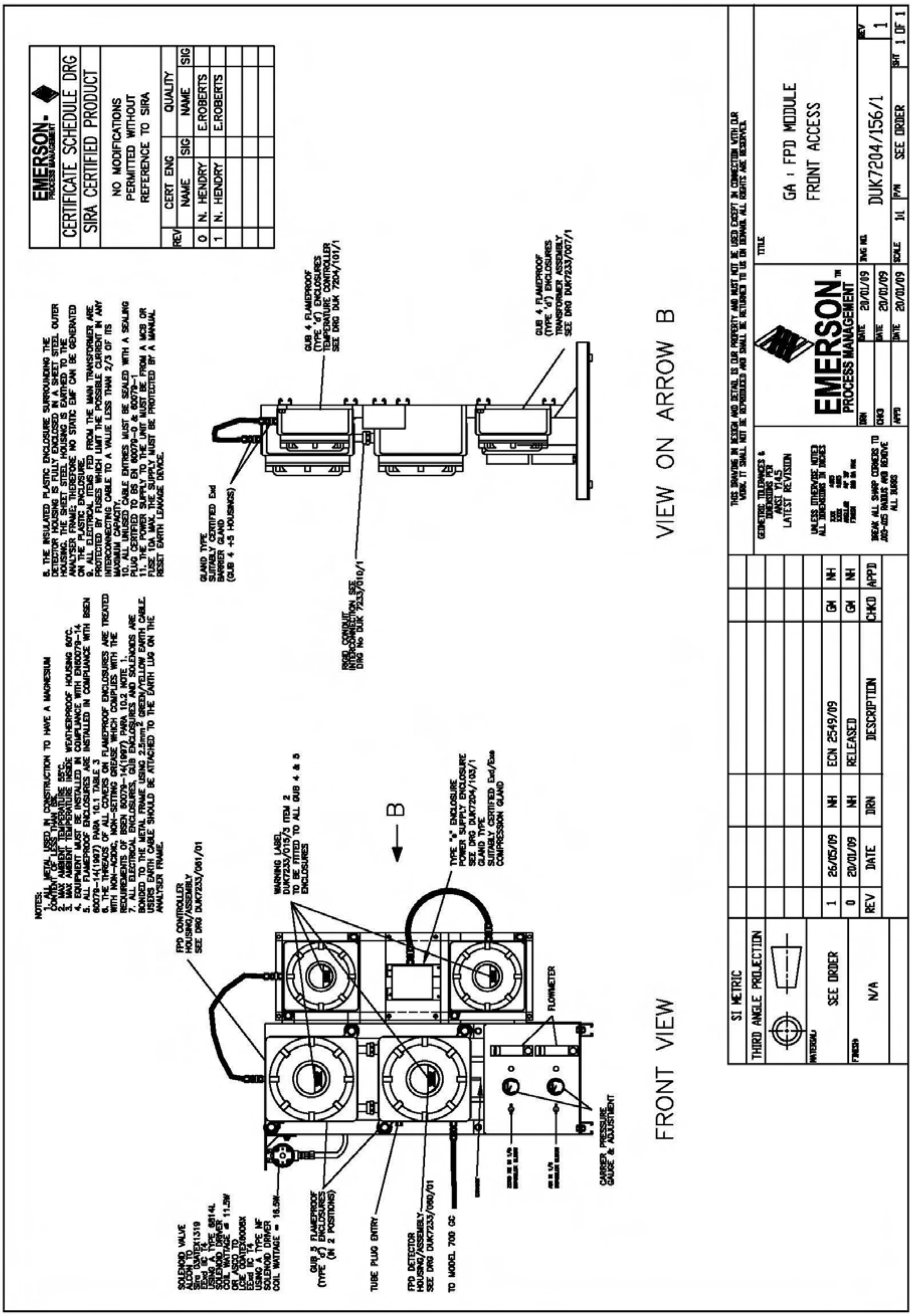
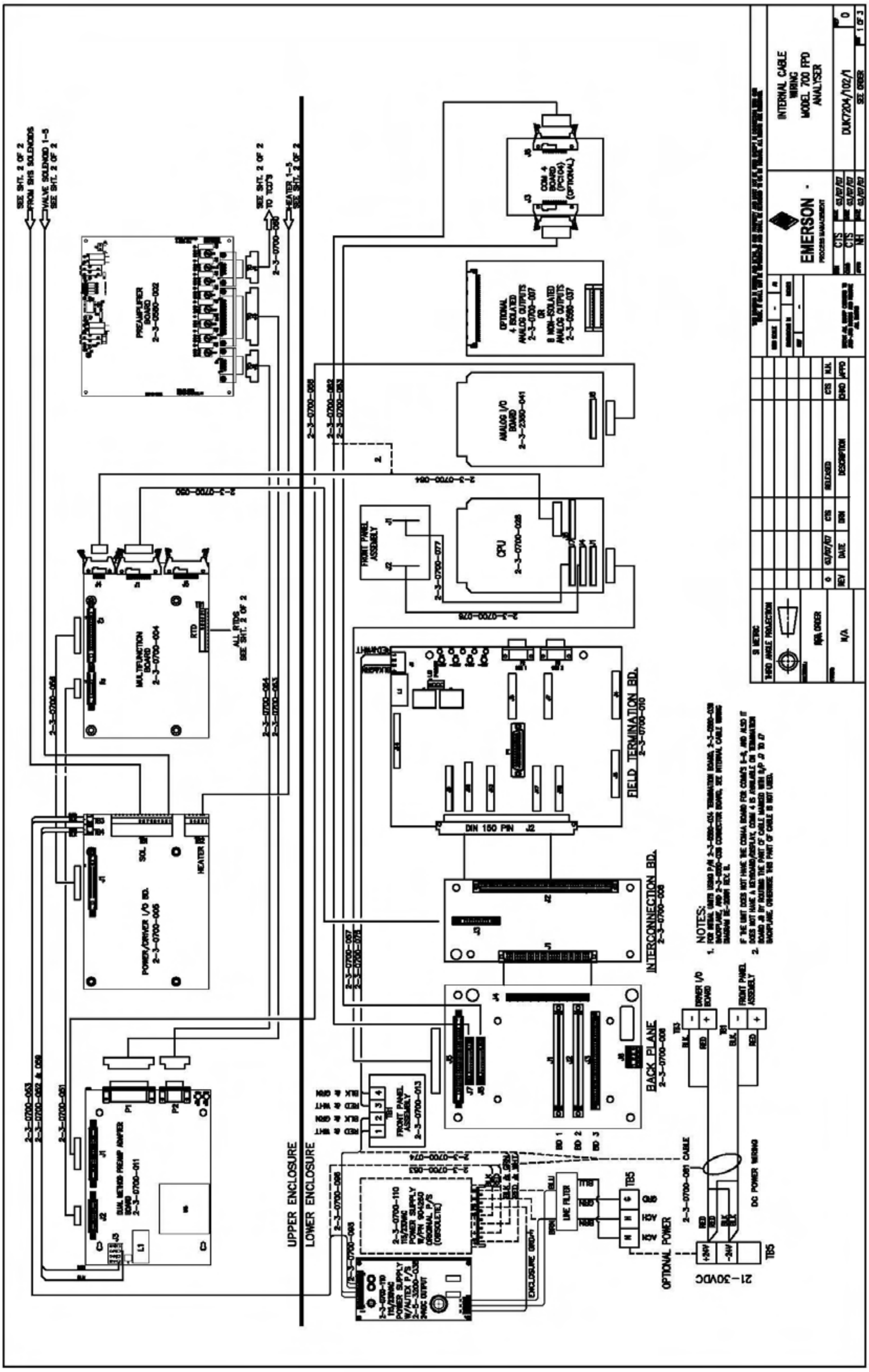
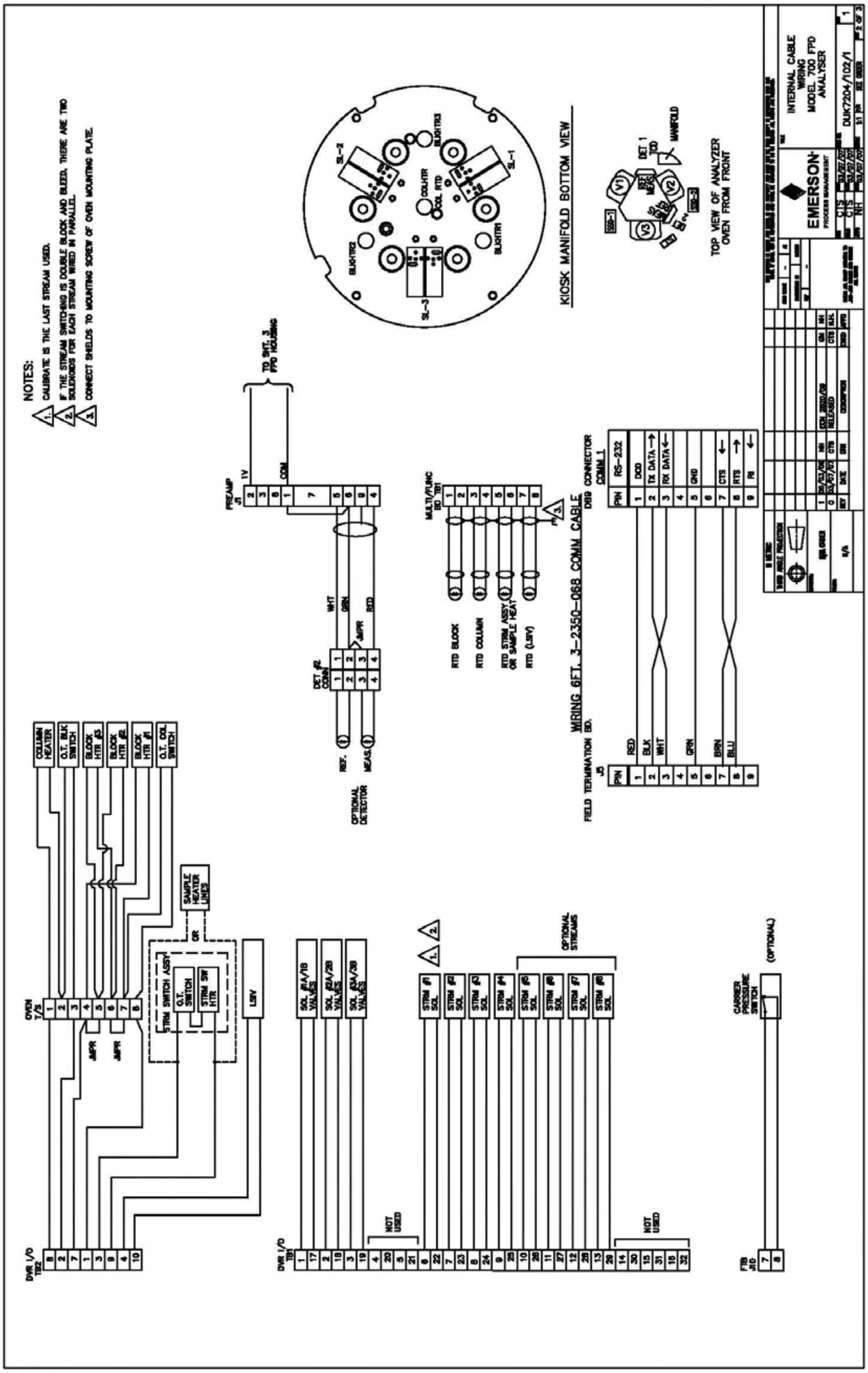
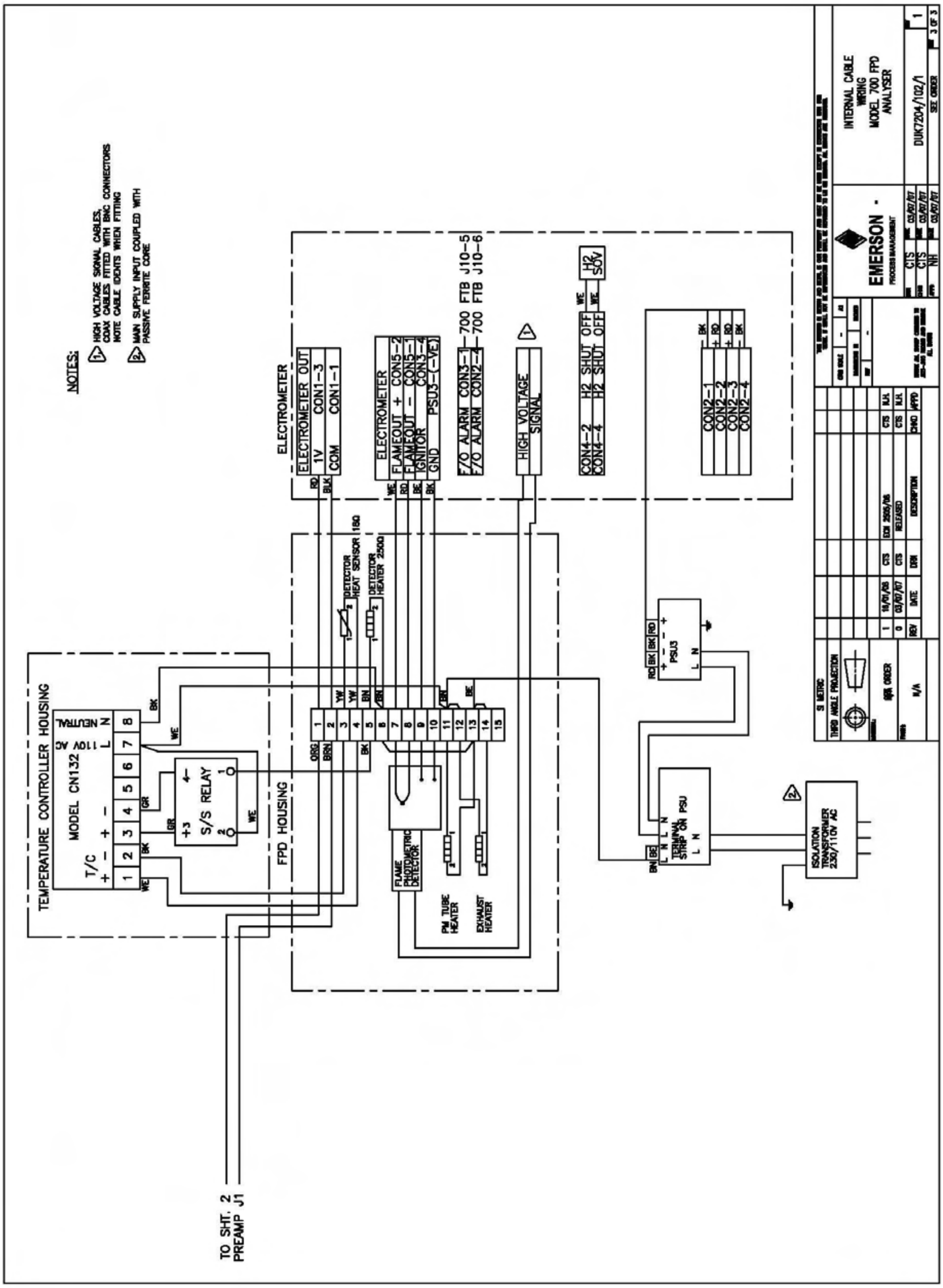
GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION
UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS
EMERSON PROCESS MANAGEMENT
DRN CTS DATE 03/07/07
CHKD CTS DATE 03/07/07
APPD DG DATE 03/07/07
TITLE MODEL 700 FPD MODULE G/A
DWG NO. DUK7204/100/1
REV 2
SCALE 1:1 P/N SEE ORDER SHT 1 OF 1

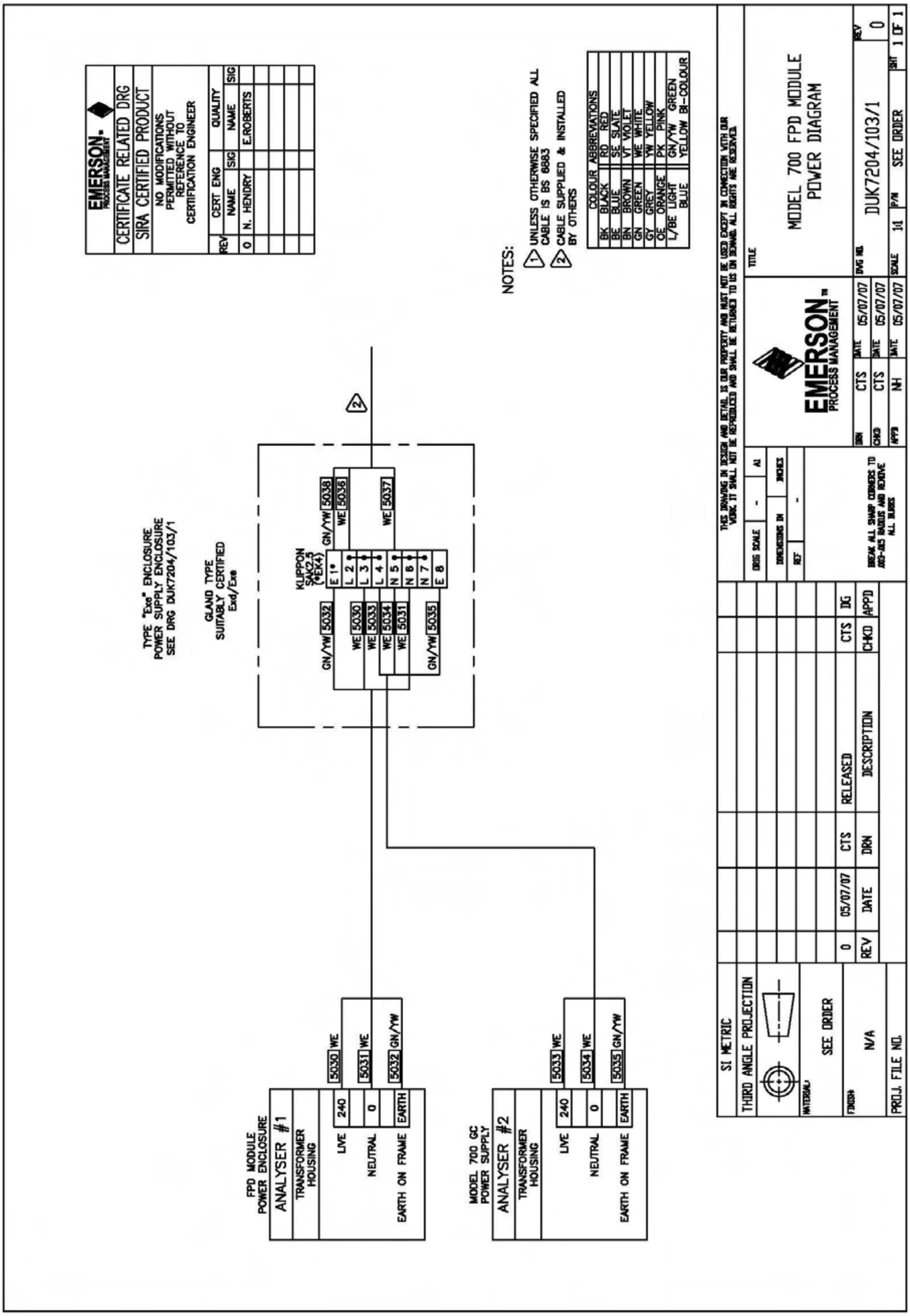


EMERSON PROCESS MANAGEMENT
CERTIFICATE SCHEDULE DRG
SIRA CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO SIRA
CERT ENG
QUALITY
N. HENDRY
E.ROBERTS
FRONT VIEW
VIEW ON ARROW B
SI METRIC
THIRD ANGLE PROJECTION
SEE ORDER
N/A
26/05/09
20/01/09
ECN 2549/09
RELEASED
REV
DATE
DRN
DESCRIPTION
CHKD
APPD
GA : FPD MODULE
FRONT ACCESS
DUK7204/156/1
1 OF 1


UPPER ENCLOSURE
LOWER ENCLOSURE
BACK PLANE
2-3-0700-008
INTERCONNECTION BD.
2-3-0700-009
FIELD TERMINATION BD.
2-3-0700-010
DIN 150 PIN J2
CPU
FRONT PANEL ASSEMBLY
NOTES:
EMERSON
PROCESS MANAGEMENT
INTERNAL CABLE WIRING MODEL 700 FPD ANALYSER
DUK7204/102/1
21-30VDC
OPTIONAL POWER

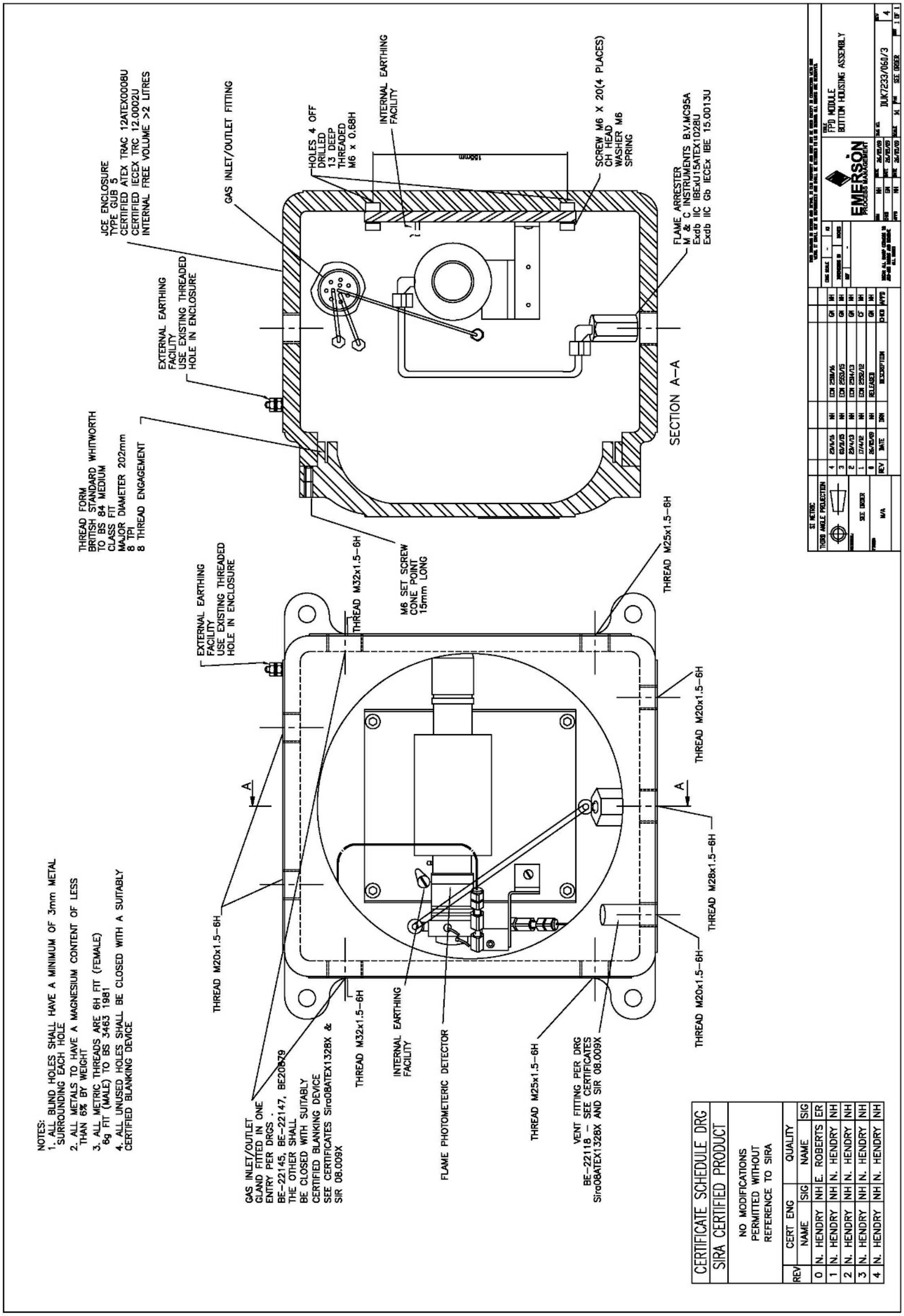

NOTES:
1. CALIBRATE IS THE LAST STREAM USED.
2. IF THE STREAM SWITCHING IS DOUBLE BLOCK AND BLEED, THERE ARE TWO SOLENOIDS FOR EACH STREAM WIRED IN PARALLEL.
3. CONNECT SHIELDS TO MOUNTING SCREW OF OVEN MOUNTING PLATE.
KIOSK MANIFOLD BOTTOM VIEW
TOP VIEW OF ANALYZER OVEN FROM FRONT
WIRING 6FT. 3-2350-068 COMM CABLE
FIELD TERMINATION BD. J5
DB9 CONNECTOR COMM 1
TO SHT. 3 FPD HOUSING
OPTIONAL DETECTOR
OPTIONAL STREAMS
CARRIER PRESSURE SWITCH
(OPTIONAL)
EMERSON PROCESS MANAGEMENT
INTERNAL CABLE WIRING MODEL 700 FPD ANALYSER
DUK7204/102/1

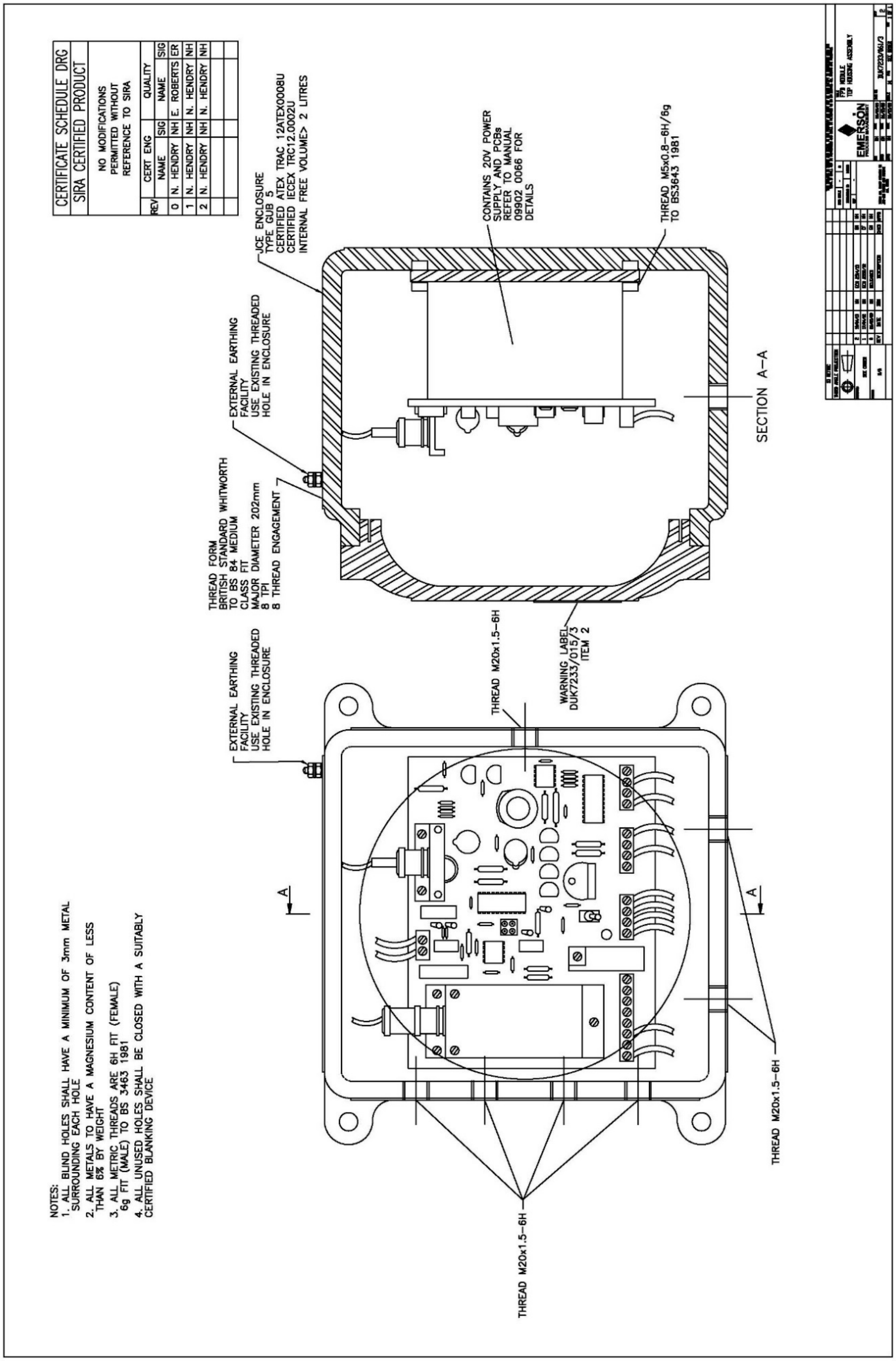

NOTES:
HIGH VOLTAGE SIGNAL CABLES, COAX CABLES FITTED WITH BNC CONNECTORS NOTE CABLE IDENTS WHEN FITTING
MAIN SUPPLY INPUT COUPLED WITH PASSIVE FERRITE CORE
ELECTROMETER
ELECTROMETER OUT
1V CON1-3
COM CON1-1
ELECTROMETER
FLAMEOUT + CON5-2
FLAMEOUT - CON5-1
IGNITOR CON3-4
GND PSU3-(-VE)
F/O ALARM CON3-1 700 FTB J10-5
F/O ALARM CON2-4 700 FTB J10-6
HIGH VOLTAGE SIGNAL
CON4-2 H2 SHUT OFF
CON4-4 H2 SHUT OFF
H2 SOV
CON2-1
CON2-2
CON2-3
CON2-4
PSU3
TERMINAL STRIP ON PSU
ISOLATION TRANSFORMER 230/110V AC
TEMPERATURE CONTROLLER HOUSING
MODEL CN132
T/C
110V AC
NEUTRAL
S/S RELAY
FPD HOUSING
DETECTOR HEAT SENSOR 18Ω
DETECTOR HEATER 250Ω
FLAME PHOTOMETRIC DETECTOR
PM TUBE HEATER
EXHAUST HEATER
TO SHT. 2 PREAMP J1
EMERSON
PROCESS MANAGEMENT
INTERNAL CABLE WIRING MODEL 700 FPD ANALYSER
DUK7204/102/1
SEE ORDER
3 OF 3

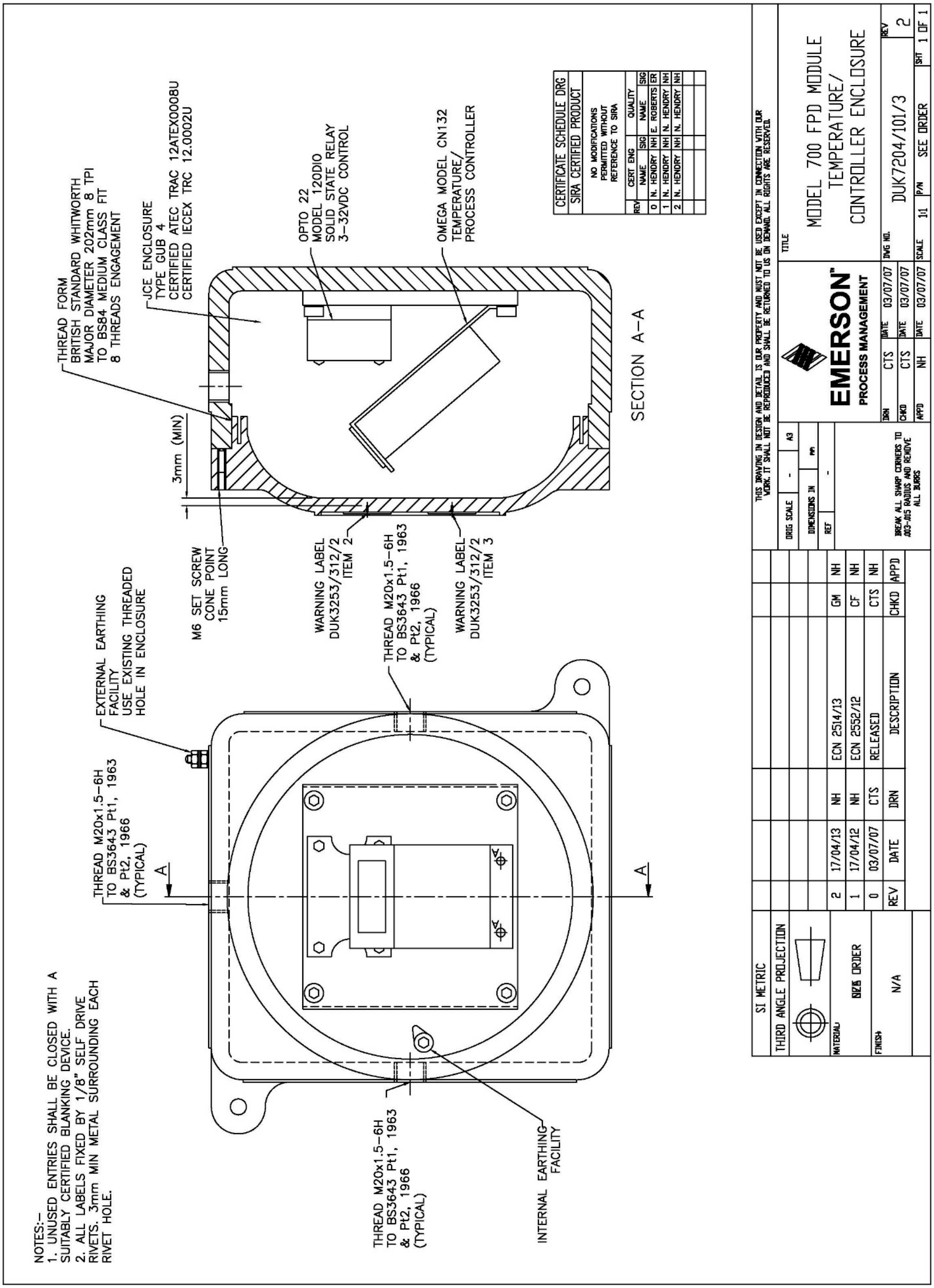

EMERSON PROCESS MANAGEMENT
CERTIFICATE RELATED DRG
SIRA CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO CERTIFICATION ENGINEER
NOTES:
UNLESS OTHERWISE SPECIFIED ALL CABLE IS BS 6883
CABLE SUPPLIED & INSTALLED BY OTHERS
TYPE "Exe" ENCLOSURE POWER SUPPLY ENCLOSURE SEE DRG DUK7204/103/1
GLAND TYPE SUITABLY CERTIFIED Exd/Exe
FPD MODULE POWER ENCLOSURE
ANALYSER #1
MODEL 700 GC POWER SUPPLY
ANALYSER #2
TRANSFORMER HOUSING
LIVE
NEUTRAL
EARTH ON FRAME
MODEL 700 FPD MODULE POWER DIAGRAM
DUK7204/103/1
SEE ORDER

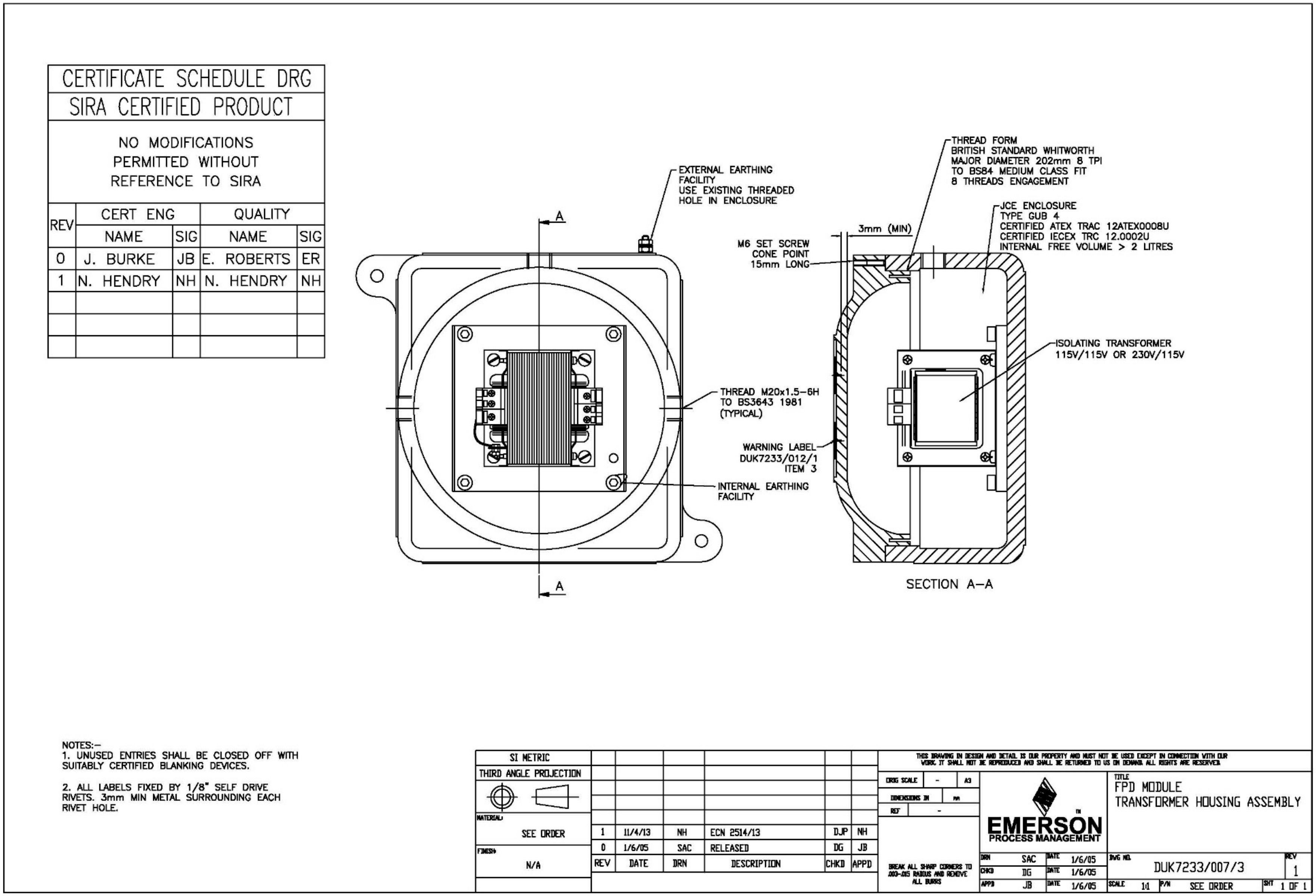
A.3 Enclosure threaded entry details

DUK 7233/060/3	FPD Module Bottom Housing Assembly
DUK 7233/061/3	FPD Module Top Housing Assembly
DUK 7204/101/3	Model 700 FPD Module Temperature/Controller Enclosure
DUK 7233/007/3	FPD Module Transformer Housing Assembly


NOTES:
1. ALL BLIND HOLES SHALL HAVE A MINIMUM OF 3mm METAL SURROUNDING EACH HOLE
2. ALL METALS TO HAVE A MAGNESIUM CONTENT OF LESS THAN 6% BY WEIGHT
3. ALL METRIC THREADS ARE 6H FIT (FEMALE) 6g FIT (MALE) TO BS 3463 1981
4. ALL UNUSED HOLES SHALL BE CLOSED WITH A SUITABLY CERTIFIED BLANKING DEVICE
GAS INLET/OUTLET GLAND FITTED IN ONE ENTRY PER DRGS. BE-22145, BE-22147, BE20879 THE OTHER SHALL BE CLOSED WITH SUITABLY CERTIFIED BLANKING DEVICE SEE CERTIFICATES Sira08ATEX1328X & SIR 08.009X
THREAD M20x1.5-6H
THREAD M32x1.5-6H
INTERNAL EARTHING FACILITY
FLAME PHOTOMETERIC DETECTOR
THREAD M25x1.5-6H
VENT FITTING PER DRG BE-22118 - SEE CERTIFICATES Sira08ATEX1328X AND SIR 08.009X
THREAD M20x1.5-6H
THREAD M28x1.5-6H
THREAD M20x1.5-6H
THREAD M25x1.5-6H
EXTERNAL EARTHING FACILITY USE EXISTING THREADED HOLE IN ENCLOSURE
THREAD M32x1.5-6H
M6 SET SCREW CONE POINT 15mm LONG
THREAD FORM BRITISH STANDARD WHITWORTH TO BS 84 MEDIUM CLASS FIT MAJOR DIAMETER 202mm 8 TPI 8 THREAD ENGAGEMENT
EXTERNAL EARTHING FACILITY USE EXISTING THREADED HOLE IN ENCLOSURE
JCE ENCLOSURE TYPE GUB 5 CERTIFIED ATEX TRAC 12ATEX0008U CERTIFIED IECEX TRC 12.0002U INTERNAL FREE VOLUME >2 LITRES
GAS INLET/OUTLET FITTING
HOLES 4 OFF DRILLED 13 DEEP THREADED M6 x 0.68H
INTERNAL EARTHING FACILITY
SCREW M6 X 20(4 PLACES) CH HEAD WASHER M6 SPRING
FLAME ARRESTER M & C INSTRUMENTS B.V.MC95A Exdb IIC IBExU15ATEX1028U Exdb IIC Gb IECEx IBE 15.0013U
SECTION A-A
A
A
CERTIFICATE SCHEDULE DRG
SIRA CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO SIRA
REV | CERT ENG NAME | SIG | QUALITY NAME | SIG
0 | N. HENDRY | NH | E. ROBERTS | ER
1 | N. HENDRY | NH | N. HENDRY | NH
2 | N. HENDRY | NH | N. HENDRY | NH
3 | N. HENDRY | NH | N. HENDRY | NH
4 | N. HENDRY | NH | N. HENDRY | NH
EMERSON PROCESS MANAGEMENT
FPD MODULE BOTTOM HOUSING ASSEMBLY
DUK7233/060/3
SEE ORDER


CERTIFICATE SCHEDULE DRG
SIRA CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO SIRA
REV | CERT ENG NAME | SIG | QUALITY NAME | SIG
0 | N. HENDRY | NH | E. ROBERTS | ER
1 | N. HENDRY | NH | N. HENDRY | NH
2 | N. HENDRY | NH | N. HENDRY | NH
JCE ENCLOSURE TYPE GUB 5 CERTIFIED ATEX TRAC 12ATEX0008U CERTIFIED IECEX TRC12.0002U INTERNAL FREE VOLUME> 2 LITRES
CONTAINS 20V POWER SUPPLY AND PCBs REFER TO MANUAL 09902 0066 FOR DETAILS
THREAD M5x0.8-6H/6g TO BS3643 1981
EXTERNAL EARTHING FACILITY USE EXISTING THREADED HOLE IN ENCLOSURE
THREAD FORM BRITISH STANDARD WHITWORTH TO BS 84 MEDIUM CLASS FIT MAJOR DIAMETER 202mm 8 TPI 8 THREAD ENGAGEMENT
SECTION A-A
THREAD M20x1.5-6H
WARNING LABEL DUK7233/015/3 ITEM 2
EXTERNAL EARTHING FACILITY USE EXISTING THREADED HOLE IN ENCLOSURE
A
A
THREAD M20x1.5-6H
THREAD M20x1.5-6H
NOTES:
1. ALL BLIND HOLES SHALL HAVE A MINIMUM OF 3mm METAL SURROUNDING EACH HOLE
2. ALL METALS TO HAVE A MAGNESIUM CONTENT OF LESS THAN 6% BY WEIGHT
3. ALL METRIC THREADS ARE 6H FIT (FEMALE) 6g FIT (MALE) TO BS 3463 1981
4. ALL UNUSED HOLES SHALL BE CLOSED WITH A SUITABLY CERTIFIED BLANKING DEVICE
EMERSON


NOTES:-
1. UNUSED ENTRIES SHALL BE CLOSED WITH A SUITABLY CERTIFIED BLANKING DEVICE.
2. ALL LABELS FIXED BY 1/8" SELF DRIVE RIVETS. 3mm MIN METAL SURROUNDING EACH RIVET HOLE.
THREAD M20x1.5-6H TO BS3643 Pt1, 1963 & Pt2, 1966 (TYPICAL)
EXTERNAL EARTHING FACILITY USE EXISTING THREADED HOLE IN ENCLOSURE
M6 SET SCREW CONE POINT 15mm LONG
WARNING LABEL DUK3253/312/2 ITEM 2
WARNING LABEL DUK3253/312/2 ITEM 3
INTERNAL EARTHING FACILITY
A
A
3mm (MIN)
THREAD FORM BRITISH STANDARD WHITWORTH MAJOR DIAMETER 202mm 8 TPI TO BS84 MEDIUM CLASS FIT 8 THREADS ENGAGEMENT
JCE ENCLOSURE TYPE GUB 4 CERTIFIED ATEC TRAC 12ATEX0008U CERTIFIED IECEX TRC 12.0002U
OPTO 22 MODEL 120DIO SOLID STATE RELAY 3-32VDC CONTROL
OMEGA MODEL CN132 TEMPERATURE/ PROCESS CONTROLLER
SECTION A-A
CERTIFICATE SCHEDULE DRG
SIRA CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO SIRA
REV | CERT ENG NAME | SIG | QUALITY NAME | SIG
0 | N. HENDRY | NH | E. ROBERTS | ER
1 | N. HENDRY | NH | N. HENDRY | NH
2 | N. HENDRY | NH | N. HENDRY | NH
SI METRIC
THIRD ANGLE PROJECTION
MATERIAL
SEE ORDER
FINISH
N/A
REV | DATE | DRN | DESCRIPTION | CHKD | APPD
2 | 17/04/13 | NH | ECN 2514/13 | GM | NH
1 | 17/04/12 | NH | ECN 2552/12 | CF | NH
0 | 03/07/07 | CTS | RELEASED | CTS | NH
DRG SCALE - A3
DIMENSIONS IN mm
REF -
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS
THIS DRAWING IN DESIGN AND DETAIL IS OUR PROPERTY AND MUST NOT BE USED EXCEPT IN CONNECTION WITH OUR WORK. IT SHALL NOT BE REPRODUCED AND SHALL BE RETURNED TO US ON DEMAND. ALL RIGHTS ARE RESERVED.
EMERSON PROCESS MANAGEMENT
DRN CTS DATE 03/07/07
CHKD CTS DATE 03/07/07
APPD NH DATE 03/07/07
TITLE
MODEL 700 FPD MODULE TEMPERATURE/ CONTROLLER ENCLOSURE
DWG NO. DUK7204/101/3
REV 2
SCALE 1:1
P/N SEE ORDER
SHT 1 OF 1


CERTIFICATE SCHEDULE DRG
SIRA CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO SIRA
REV | CERT ENG NAME | SIG | QUALITY NAME | SIG
0 | J. BURKE | JB | E. ROBERTS | ER
1 | N. HENDRY | NH | N. HENDRY | NH
EXTERNAL EARTHING FACILITY USE EXISTING THREADED HOLE IN ENCLOSURE
M6 SET SCREW CONE POINT 15mm LONG
3mm (MIN)
THREAD FORM BRITISH STANDARD WHITWORTH MAJOR DIAMETER 202mm 8 TPI TO BS84 MEDIUM CLASS FIT 8 THREADS ENGAGEMENT
JCE ENCLOSURE TYPE GUB 4 CERTIFIED ATEX TRAC 12ATEX0008U CERTIFIED IECEX TRC 12.0002U INTERNAL FREE VOLUME > 2 LITRES
ISOLATING TRANSFORMER 115V/115V OR 230V/115V
THREAD M20x1.5-6H TO BS3643 1981 (TYPICAL)
WARNING LABEL DUK7233/012/1 ITEM 3
INTERNAL EARTHING FACILITY
A
A
SECTION A-A
NOTES:-
1. UNUSED ENTRIES SHALL BE CLOSED OFF WITH SUITABLY CERTIFIED BLANKING DEVICES.
2. ALL LABELS FIXED BY 1/8" SELF DRIVE RIVETS. 3mm MIN METAL SURROUNDING EACH RIVET HOLE.
SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: SEE ORDER
FINISH: N/A
1 | 11/4/13 | NH | ECN 2514/13 | DJP | NH
0 | 1/6/05 | SAC | RELEASED | DG | JB
REV | DATE | DRN | DESCRIPTION | CHKD | APPD
THIS DRAWING IN DESIGN AND DETAIL IS OUR PROPERTY AND MUST NOT BE USED EXCEPT IN CONNECTION WITH OUR WORK. IT SHALL NOT BE REPRODUCED AND SHALL BE RETURNED TO US ON DEMAND. ALL RIGHTS ARE RESERVED.
ORIG SCALE - A3
DIMENSIONS IN mm
REF -
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS
EMERSON PROCESS MANAGEMENT
DRN SAC DATE 1/6/05
CHKD DG DATE 1/6/05
APPD JB DATE 1/6/05
TITLE FPD MODULE TRANSFORMER HOUSING ASSEMBLY
DWG NO. DUK7233/007/3
REV 1
SCALE 1:1 P/N SEE ORDER SHT 1 OF 1

B Appendix B: Manufacturer's manuals

- Flame Photometric Detector Operation Manual
- PID Controller Manual

B.1 FlamePhotometric Detector Operation Manual

23332-K026

Revision B April 25th, 2008

IMPORTANT

In order to obtain optimum performance from this detector, it is necessary to meet and maintain the following conditions:

A. The following minimum purity standard for gases and liquids shall be maintained:

Helium - 99.999% (ultra high purity) or Nitrogen - 99.999% (ultra high purity) Hydrogen - 99.999% (ultra high purity)

Air - 0.1 PPM total Hydrocarbons (ultra zero grade)

B. Stainless steel diaphragm regulators must be used.

C. All gas lines from source to instrument must be clean.

B.1.1 General Description

Introduction

The Flame Photometric Detector, FPD, is a very sensitive and selective detector for the analysis of sulfur or organophosphorus containing compounds. The detector is very stable and easy to use. As the analyte is burned in a hydrogen and air flame, a characteristic wavelength of light is emitted at 394 nm for sulfur and 526 nm for phosphorus. A filter specific to the appropriate wavelength may be installed to enhance the selectivity to the sulfur or phosphorus emission. The emitted light is amplified by the photomultiplier tube (PTM) and processed by the signal processor. 'The response to phosphorus is linear and quadratic to sulfur.

The detector may be operated in either the sulfur mode or phosphorus mode by switching the filter and adjusting the air to hydrogen ratio to optimize response. A shielded flame design of the detector enhances sensitivity by lowering the noise created by the light emitted by the flame.

The detector uses a stainless steel jet, quartz windows, and silicone 0-rings in an all aluminum body.

Specifications

- Maximum operating temperature: 250 °C
- Shielded stainless steel jet
- Sensitivity: 2 x 10^{-12} g/sec for sulfur
- Sensitivity: 1 x 10^{-12} g/sec for phosphorus
- Linear range: 10^4 for phosphorus
- Linear range: 10^3 with optional square root function for sulfur
- Leak tight design to allow measurement of all flows from detector exhaust
- Igniter voltage: 1.5V AC at 4 amps
- PMT voltage variable from approximately 650V

Installation of the FPD Optical filter

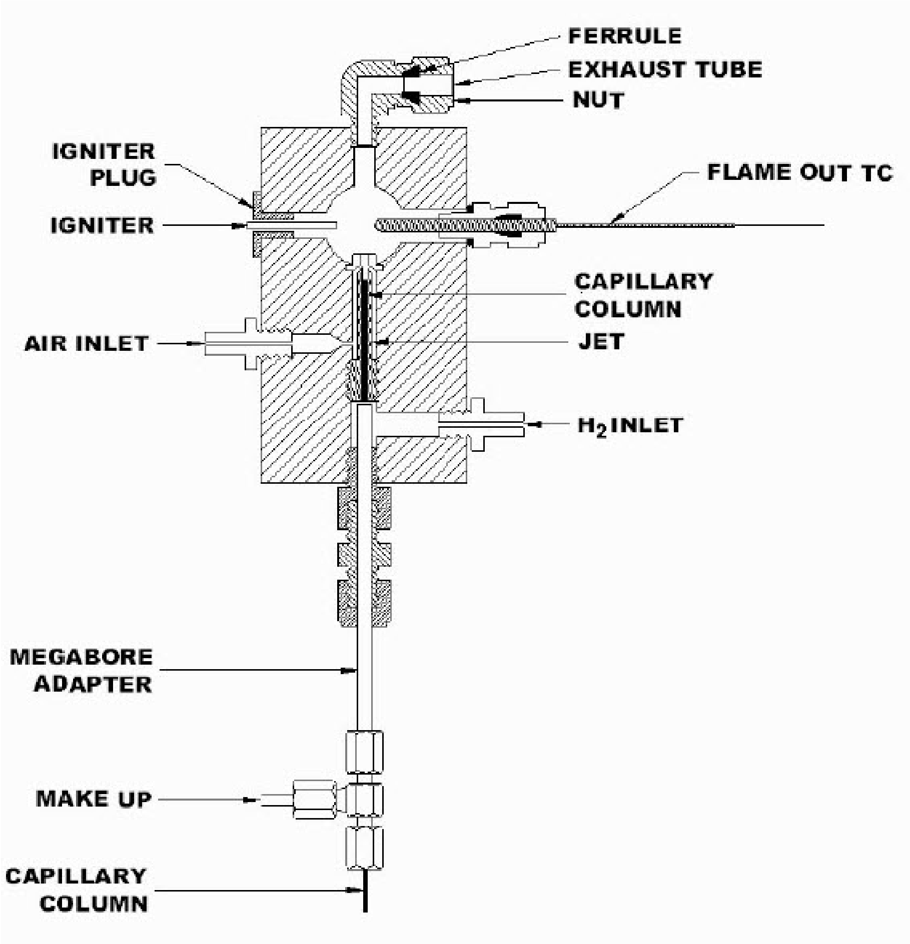
In order to have the specificity for sulfur or phosphorus detection the appropriate optical filter must be in place. The phosphorus filter is a filter of 526 nanometers and the sulfur is a filter of 396 nanometers.

Before changing the filter, the power cable to the photomultiplier tube, PMT, must be removed. This will prevent irreparable damage which can be caused by the introduction of room light to the PMT. The two thumb screws securing the PMT to the detector body are removed and then the PMT is slid off gently. Some resistance is felt due to the O-ring on the detector body which provides a light tight seal.

The filter may be removed and replaced with the appropriate filter. The sulfur filter is a very dark blue color and the phosphorus filter a fluorescent yellow green. One side of the filter has a mirror finish. There is not a front or back face to the filter.

The PMT is slid back in place and the two thumb screws secured to the detector body. Reattach the power mid signal cables to the back of the PMT.

Figure B-1: Insertion of Capillary Column into the FPD



Operation

CAUTION

When working with the detector, never remove the photomultiplier from the detector with the dynode voltage applied. Exposure to high light levels will cause photocathode fatigue (sensitivity loss for an extended period of time) and may cause permanent damage.

Optimal detector temperature

The FPD may operate up to a temperature of 250 °C. Take care to operate the detector above the final temperature of the column to prevent the condensation of column bleed on the surface of the optical windows which could result in loss of response.

CAUTION

Do not operate the detector above 250 °C or you may damage the plastic photomultiplier housing.

Optimizing flows and igniting the flame

The optimization of the detector is achieved by adjusting the ratio of hydrogen to air. The oxygen content of air should be 0.2 - 0.4 of the hydrogen flow, with the optimum ratio being 0.3. The air flow should be 1.5 times the hydrogen flow. When optimizing conditions, the higher the total gas flows; the higher the background noise.

Example:

Hydrogen flow 100 mL/min

100 mL/min x 1.5 = 150 mL/min air required

Nitrogen is the most common carrier gas used for packed columns. Helium is used for the carrier gas for capillary column s with nitrogen for the make-up gas.

Once the flows are set and the detector is at a temperature of at least 125 °C, the flame may be lit.

Selecting the Linear or Square Root Mode of Operation

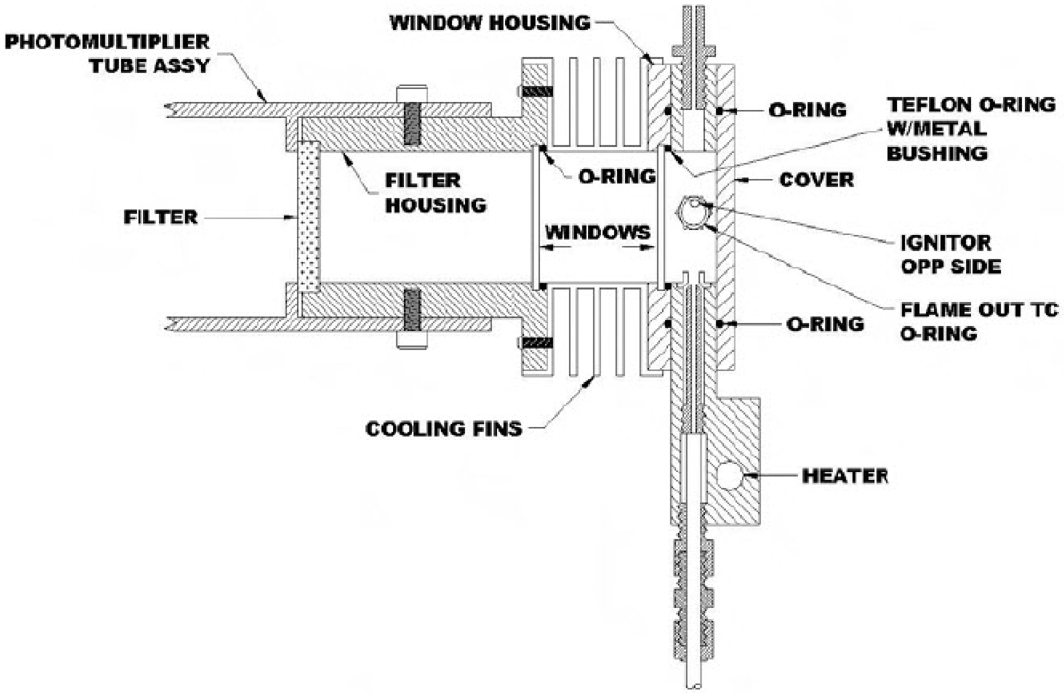
The FPD electrometer has two modes of operation designated as" linear" and "square root". To select the mode of operation, use the sq rt / linear switch.

In the linear mode, the circuit performs as a basic electrometer giving a 10 volt output for an input current of one microampere. This 10 volt full scale output is available at the 10 volt output. A 1 volt output is also available. The linear mode is used when the detector is operated in the phosphorus mode of operation with the phosphorus filter installed.

Phosphorus is detected as POH.

Sulfur is detected as S2 and the response is proportional to the square of the concentration of the sulfur containing compound. The square root mode is selected from the switch marked sq rt / linear. In this mode the electrometer output is modified by a special resistor-diode matrix to correct for the non-linear (approximately square law) relationship between the detector output current and sulfur concentration when the detector is operated in the sulfur mode. When operating in the mode, the electrometer zero control should be set to provide a slightly positive output from the module with the detector output at baseline.

Figure B-2: Replacement of O-rings and Windows



Maintenance

CAUTION

When working with the detector, never remove the photomultiplier from the detector with the dynode voltage applied. Exposure to high light levels will cause photocathode fatigue (sensitivity loss for an extended period of time) and may cause permanent damage to the PMT.

Cleaning the Detector

Column bleed may build up in the FPD housing. This stationary phase coating may be rinsed out of the detector without disassembly. Follow the procedure listed below:

1. Disconnect the electrical connections from the detector.
2. Tum off the hydrogen and air supply lines to the GC.
3. Cool the detector to ambient.
4. Disconnect the column, hydrogen and air lines from the detector body.
5. Remove the detector from the GC.
6. Cap the hydrogen and air inlets with an 1/8" cap nut.
7. Flush the detector thoroughly with acetone through the column inlet port and exiting through the exhaust tube.
8. Dry the detector with nitrogen thoroughly.
9. Uncap the gas inlets and reinstall the detector onto the GC.

Replacing the O-rings and Quartz Windows

After using the detector for about twelve months at 250° or more, the O -rings may become brittle and begin to allow light to leak into the detector resulting in high background noise and loss of response. The quartz window may need to be replaced as well. There are a total of five O-rings in the O-ring replacement kit,

PIN 116910-KAL REZ. Four are Kalrez and one is Teflon. The locations of these O- rings are shown in Figure B-2. These O -rings must be replaced any time a joint sea led by one of them is separated. ' The cross section view of the detector is shown in Figure B-2.

There are two concentric O-rings between the window housing and flame base. A 1-1/4" Kalrez ring fits into a groove in the window housing itself and a 15/16" Teflon ring fits around a bushing between the window and the flame base. A 15/16" Kalrez ring is used between the window at the inner end of the filter housing and the heat radiator section. The following procedure should be used to replace the O -rings and quartz windows:

1. Disconnect the power cable from the PMT.
2. Loosen the two thumb screws on the filter housing and remove the PMT.
3. Remove the filter.
4. With a Phillips screwdriver, disconnect the heater-igniter wiring bracket from the housing assembly.
5. Pull the filter housing from the recess in the heat radiator, exposing first the window and O-ring (15/16 in. Kalrez).
6. With a hex (Allen) wrench, remove the four screws holding the radiator and window housing to the flame base.
7. Remove the heat radiator, window housing, and the window
8. Remove the old O-rings.

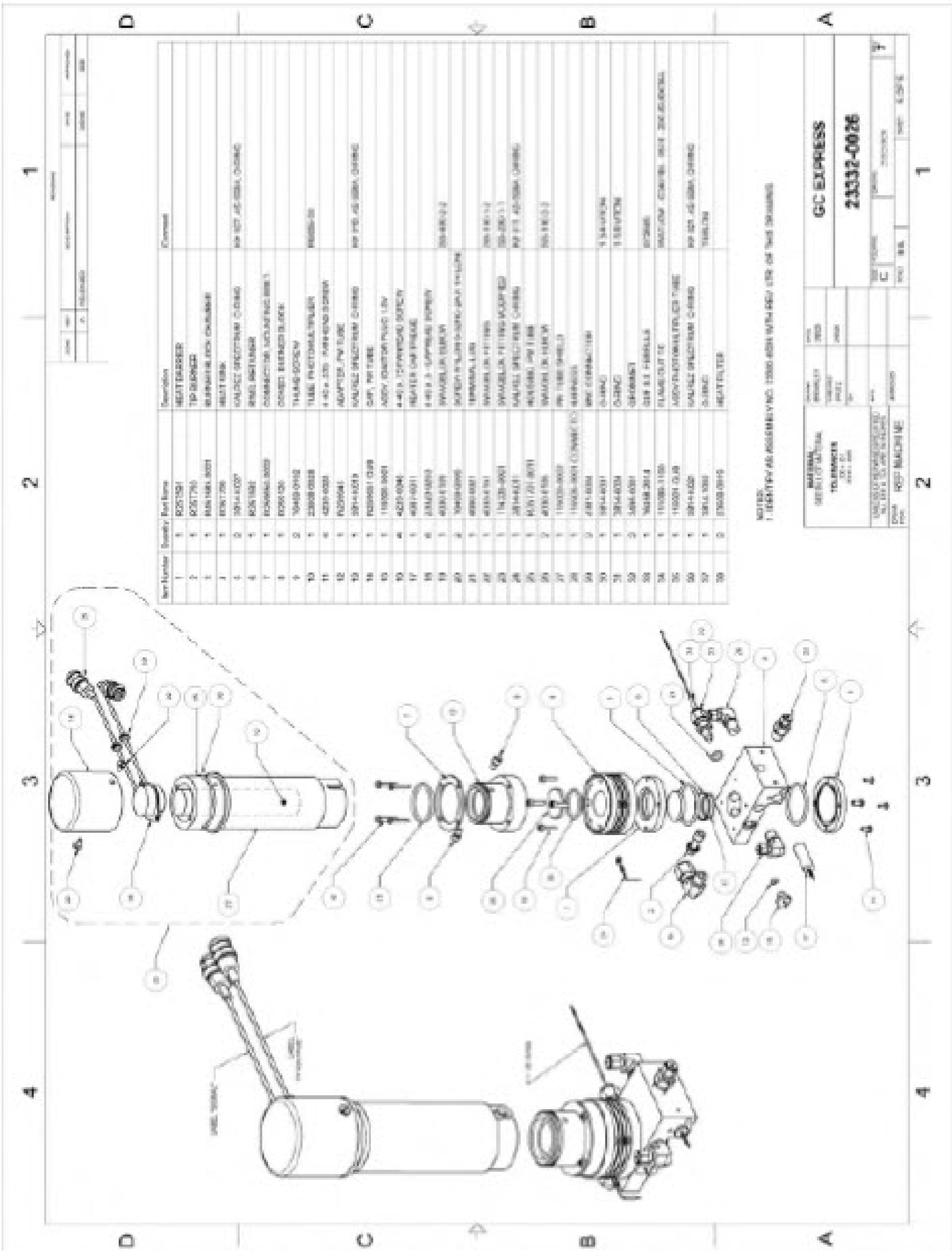
9. Place the 15/16 in. Teflon ring around the metal bushing.
10. Insert the 1-1/4-in. ring into the groove in the window housing.
11. With the bushing and its ring between the window and the flame base and grooved side of the window housing toward the flame base, align the window housing with the threaded holes in the flame base.
12. Replace the heat radiator over the window housing with countersunk holes toward the outside and aligned with the holes in the window housing and flame base.
13. Replace the Allen head screws and tighten.
14. Place the outer window in the recess in the inner end of the filter housing with the 15/16-in. Kalrez O-ring between the window and the heat radiator.
15. Replace the filter housing and the wiring bracket.
16. Replace the filter and the PMT.

The 1 -1/4-in. Kalrez end cover O-ring is located between the end cover and the flame base.

Recommended spare parts

The figure below is a cross-section diagram of the FPD with associated part numbers. The parts listed below are used in the normal maintenance of the detector.

Description	Part number
Igniter plug (includes O-ring seal) – 1.5 volt	116906-K001
Quartz window	23608-0019
O-ring kit 2 ea. # 2-27 Kalrez (1.437 O.D. x 0.70 dia cross section) 1 ea. #2-21 Kalrez (1.062 O.D. x 0.70 dia cross section) 1 ea. #c2118-021 PFTE (1.062 O.D. x 0.70 cross section) 1 ea. #568-010 Kalrez O-ring # S70010 ignitor 1 ea. #586-011 Kalrez O-ring #S70011 flame out TC	116910-KALREZ


GC EXPRESS
23332-0026
NOTES:

B.2 GUB FPD 118500-3411 GUB

B.2.1 Full function uP controlled FPD Rev G

1. FPD Processor Control Functions

   A. Power on Initialization.

   B. Reset State. The uP monitors the RESET/RUN/OVERRIDE Switch (R/R/0 Switch) (SW1), suspending any automatic operation until the R/R/ 0 Switch is set to the RUN position. If the R/R/0 Switch is set to the Override position, the uP continues to be Reset but the fuel valve will be manually activated . The fuel valve will remain activated until the R/R/0 Switch is manually switched to either the Reset or Run position.

   C. Igniter and Flame on State. When the R/R/ 0 Switch is set to the R UN position, the uP attempts to ignite the flame. Tl1e ignition sequence consists of the following steps.

      1. Tum the Igniter Drive and LED (D20) on and wait for 5 sec. This allows the igniter to reach a temperature that will cause ignition.

      2. Open the fuel valve and wait for 15 sec.

      3. Tum the Igniter Drive and LED off.

      4. Check for Flame On by monitoring the thermocouple temperature sensor input at connector CON5.

      5. If no flame is detected, fuel valve will be closed and the uP will delay for another 30 sec. before any attempt to retry the ignition sequence.

      6. If a flame is detected, the uP will continue monitoring the thermocouple temperature sensor input for a flame on indication, maintaining the fuel valve on and the LED indicator off.

If the uP does not detect a flame within 10 tries of the Ignition Sequence, it will set the igniter and fuel solenoid off and indicate a error condition by flashing the LED indicator (D20) at a steady 2Hz. An external error control signal (External Alarm), which can be used to drive a remote indicator (LED, Buzzer, Etc.), will be activated at connector CON3.l. The uP will suspend any other operation until the R/ R/0 switch has been cycled off and back on or the power has been cycled off and back on.

The uP will enter the Ignition Sequence and will attempt ignition:

a. On power up if the R/R/0 Switch is set to RUN.

b. Anytime the R/R/0 Switch is cycled from RESET or OVERRIDE to RUN.

c. In nominal operation , whenever the flame has been on and has gone out.

If the flame cannot be started within 10 tries of the Ignition Sequence , the uP will not try to re-ignite until the R/R/0 Switch has been manually cycled off and back on or the power has been turned off and back on.

Any time the R/R/0 Switch is cycled from RUN to RESET, the uP will stop fuel flow by turning the fuel solenoid off. No attempt will be made to restart the flame until the R/ R/0 Switch is returned to the RUN position.

Warning: The R/R/0 Switch is a three-position switch, and once switched to the OVERRIDE position there is no automatic termination of the fuel valve activation. This feature is used for set.up of the fuel flow only. To deactivate the fuel valve, the R/R0 Switch must be manually switched back to the RUN or RESET positions.

Refer to FPO Firmware Flowchart for detailed outline of uP functions.

2. FPD Electrometer PowerSupply:

Use caution. AC Voltage (120 Volts AC) is present and DC Voltage in excess of 600 Volts is generated on the PCB when power isapplied.

A. **Extemal Power, AC Volts:** 120 Volts AC routed thru CON4 is switched by the Solid State Relay U7 (S101DH2). The Gas Valve/Solenoid is controlled by this switched AC Voltage signal.

B. **External Power, DC Volts:** 12 Volt DC to low voltage power connector CON2. CON2, Pins I & 2, power the low current section of the PCB. CON2, Pins 3 & 4, power high current circuits (HV Regulator, Igniter, fuel solenoid, etc.).

C. On board low voltage:

1. An on board DC to DC Converter (U6) generates +/- 15 Volts

2. A LM4040 Voltage Regulator (U5) generates +5 Volts

D. On board highvoltage:

On board high voltage converter generates approximately 650 Volt DC (J4)

3. FPD Linear ModeTest

A. Set the Linear / Sq. Root Switch (SW3) to LinearMode

B. During the following test steps, monitor U3.6 output line with an oscilloscope to check for oscillation or other signs of faulty operation.

C. With Signal In input connector (J3) open, recorder span set to 1 mV. full scale andthe Zero Switch (SW4) set to OFF, adjust R57 for best output null.

D. With Signal In input connector (J3) open, set the Zero Switch (SW4) ON. Adjust the manual zero pot (R38, can be located on the PCB or mounted on the front panel) completely CW and check for an output of +0.055V to +0.075V. Adjust the zero pot completely CCW and check for a smoothly changing voltage output to -l. l5V to -1. 55V. Return the Zero voltage control to approx. 0 volts output.

E. Connect a current source to the Signal In input connector (J3). With a Voltmeter or recorder, monitor the output at the l OV output pin (CON l. 4). Change recorder span as necessary to check output range and linearity per following table.

Current source setting (AMPS)	Recorder reading at direct output
-1×10^{-10}	1.0 MV +-2%
-1×10^{-9}	10.0 MV +-2%
-1×10^{-8}	0.100 V +-2%
-1×10^{-7}	1.0 V +-2%
-1×10^{-6}	V +-2%

4. FPD Square Root Mode Test

A. Set the Linear / Sq. Root Switch (SW3) to Square Root Mode

B. Set diode oven temperature adjustment pot (R59) near the center of its range of adjustment. Monitor U3.6 with oscilloscope for oscillation or other signs of faulty circuit operation.

C. Connect a variable span recorder or DVM (10 megoluns input impedance minimum) to the lOV output (CONl. 4), and a current source to the input connector (J3). Set the ZERO SW to ON.

D. Check electrometer and recorder zeros and carefully reset if necessary. Refer to **Section 3, FPD Linear Mode Test,** for zero set procedure.

E. Set the ZERO SW to ON, the input current to -4.0 X 10^{-8} amps and adjust the diode oven temperature by means ofR59 so that when temperature stabilizes the recorder or DVM reads 31.56 mV as closely as possible.

F. Reset input current to zero and note recorder/DVM reading. Return input current to-4.0 X 1·0 [8] and trim diode oven temperature if necessary so that the difference in recorder/DVMreadings for input currents of zero and -4.0 X 10^{-8} amps is 31.56mV, plus or minus O. l mv.

G. Check response curve per following table. (If zero reading falls outside permitted limits, readjust the offset pot (R57) and repeat previous step.

Current source setting (AMPS)			Direct output (10 VFS) reading (mV)
-0.00 x 10^{-11}	-0.5 , "Zero" < +0.5	R62 = 191K	R62 = 90.9K
-2.00 x 10^{-11}	"Zero reading"	+.167 + .1	+.335 +-.1
-6.00 x 10^{-11}	"Zero reading"	+.470 + -.15	_.945+-1.5
-1.60 x 10^{-10}	"Zero reading"	+1.16 +-.2	+2.34+-.2
-6.40 x 10^{-10}	"Zero reading"	+3.34 + -.3	+6.71+-.3
-2.50 x 10^{-9}	"Zero reading"	+7.62 +-.6	+15.3 +-.6
-1.00 x 10^{-8}	"Zero reading"	+15.68 +-.9	+31.5+-.9
-4.00 x 10^{-8}	"Zero reading"	+31.56 +-.1	+63.4 +-.1
-1.60 x 10^{-7}	"Zero reading"	+64.7 +-3.0	+130 +-3.0
-6.40 x 10^{-7}	"Zero reading"	+129 +-5.0	+260 +5.0
-2.56 x 10^{-6}	"Zero reading"	+319 +-12	+641 +-12

5. Noise and Drift Test

A. Conduct test with all shields and covers in place and electrometer operating in the "square root" mode. (SW3 set to square root) Connect lOMV F.S. recorder to the Direct Output (CONl.4) with the chart speed set to approx. 0.25 cm/min. Disconnect input cable, tum the Zero Switch (SW4) ON and set the zero control pot (R38) so that trace is near center of plot.

B. Record data for at least 30 minutes in a stable ambienttemperature.

C. Acceptance specifications are as follows:

1. Max. Peak-to-peak noise - 2% of full scale.

2. Occasional unexplained spikes - no more than one per half hour and not to exceed 5% full-scale peak height.

3. Max. Drift - 1.5% full scale during half hournm.

6. FPD Thermocouple Temperature Setup.

The thermocouple input at CONS Pin1 and Pin2 will be factory adjusted to operate with Detector temperatures that range from approximately 150 Degrees C to 200 Degrees C.

ReturnOirecttoPowerSupply(GND)

SW1

8

5

1DV

LEDA

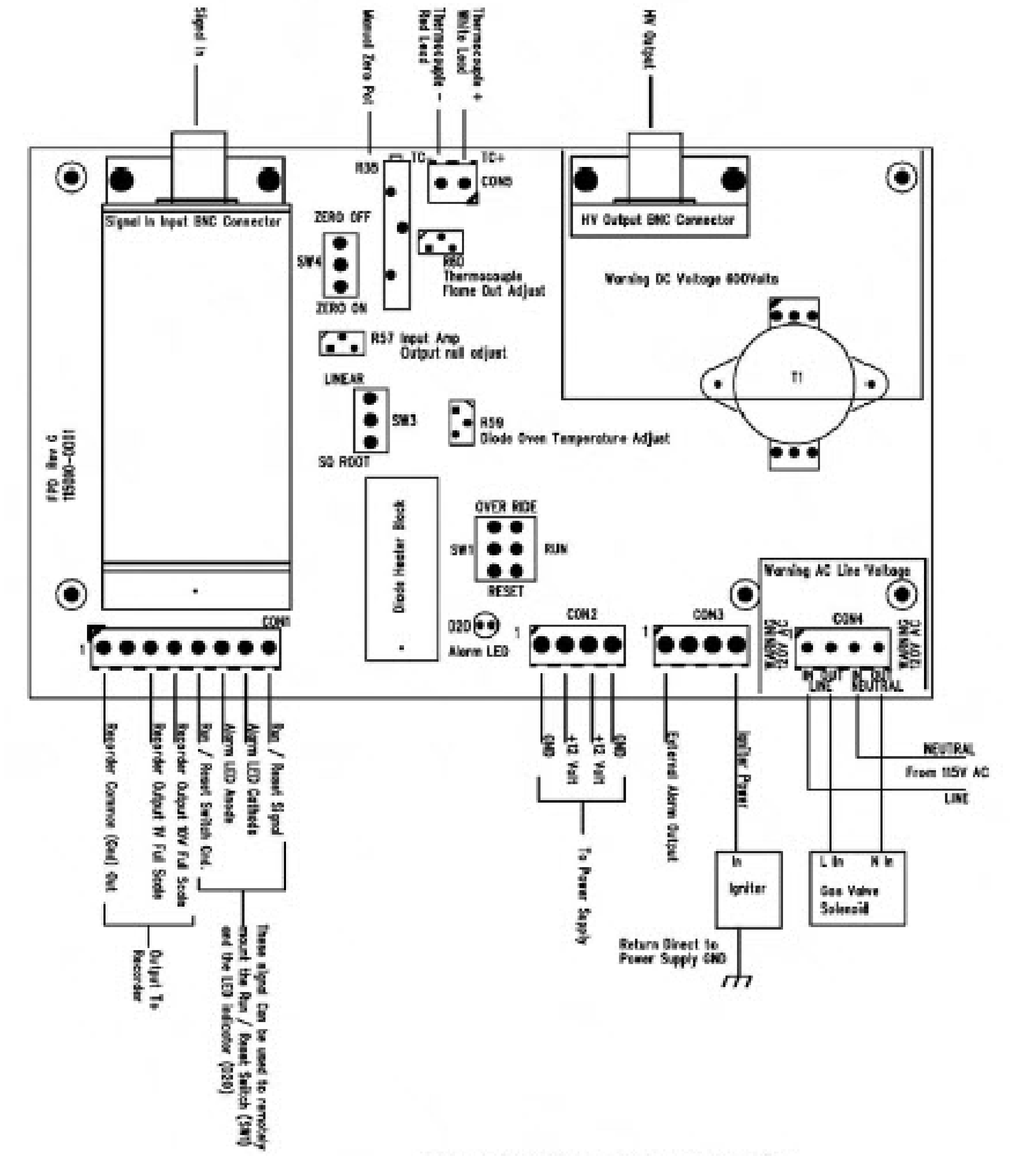
4

1V

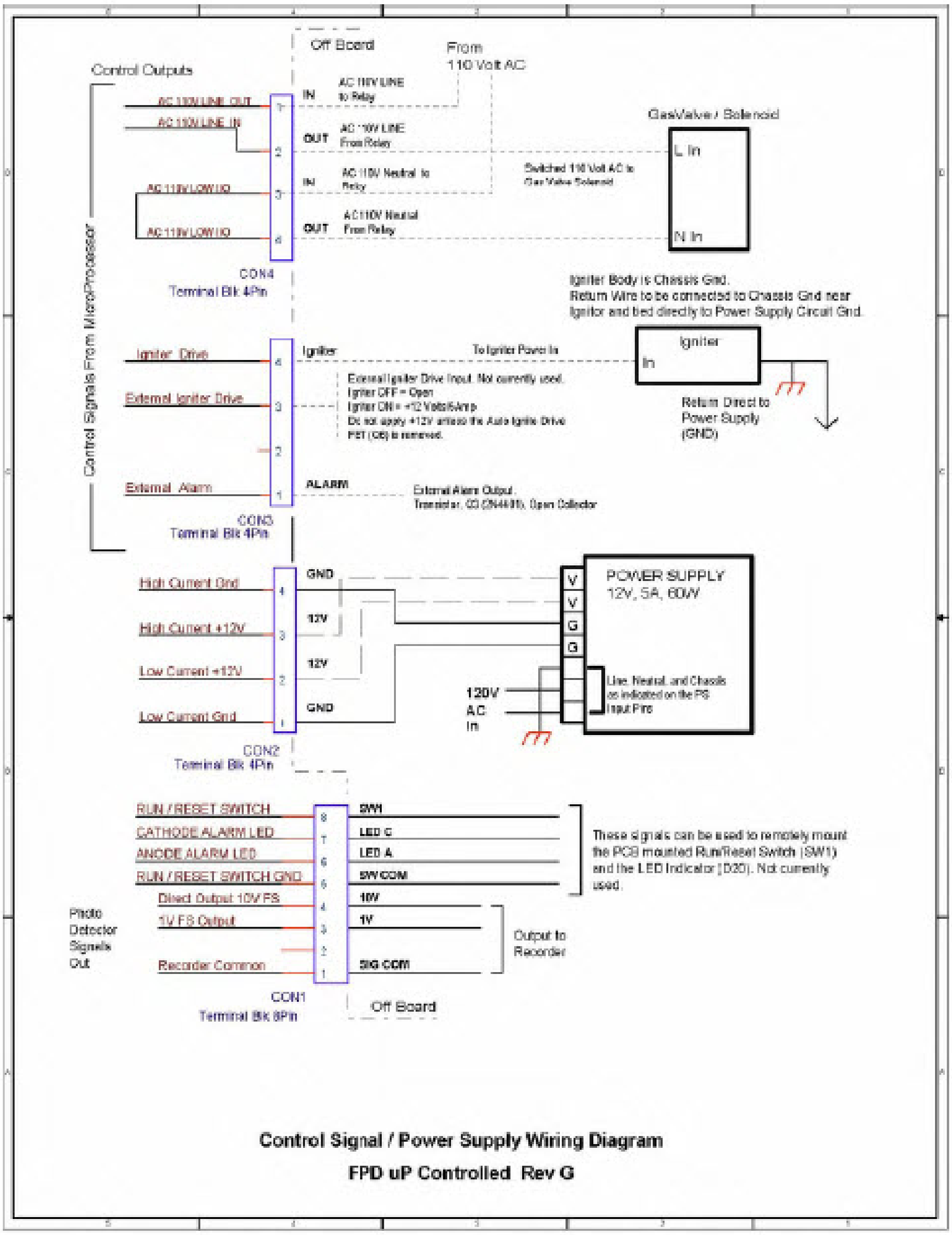
6

3

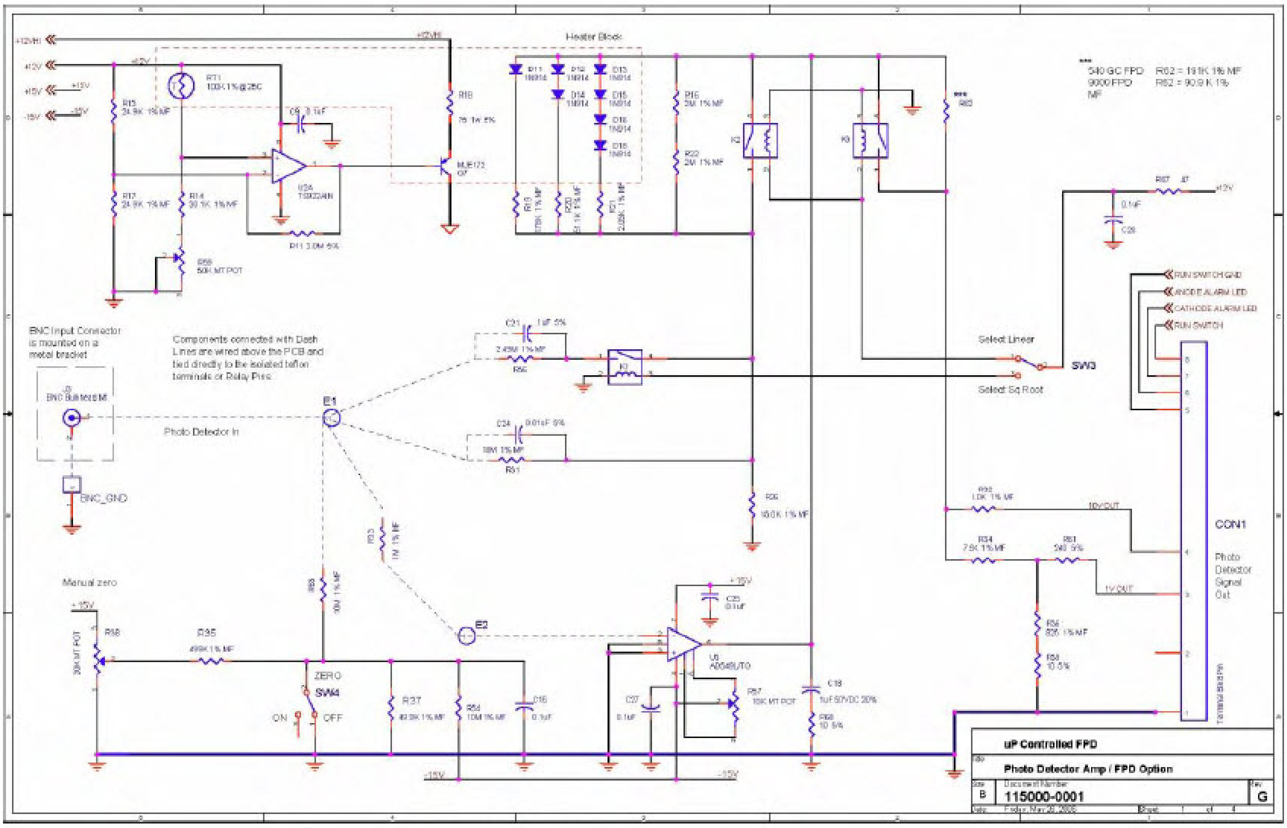
SWCOM

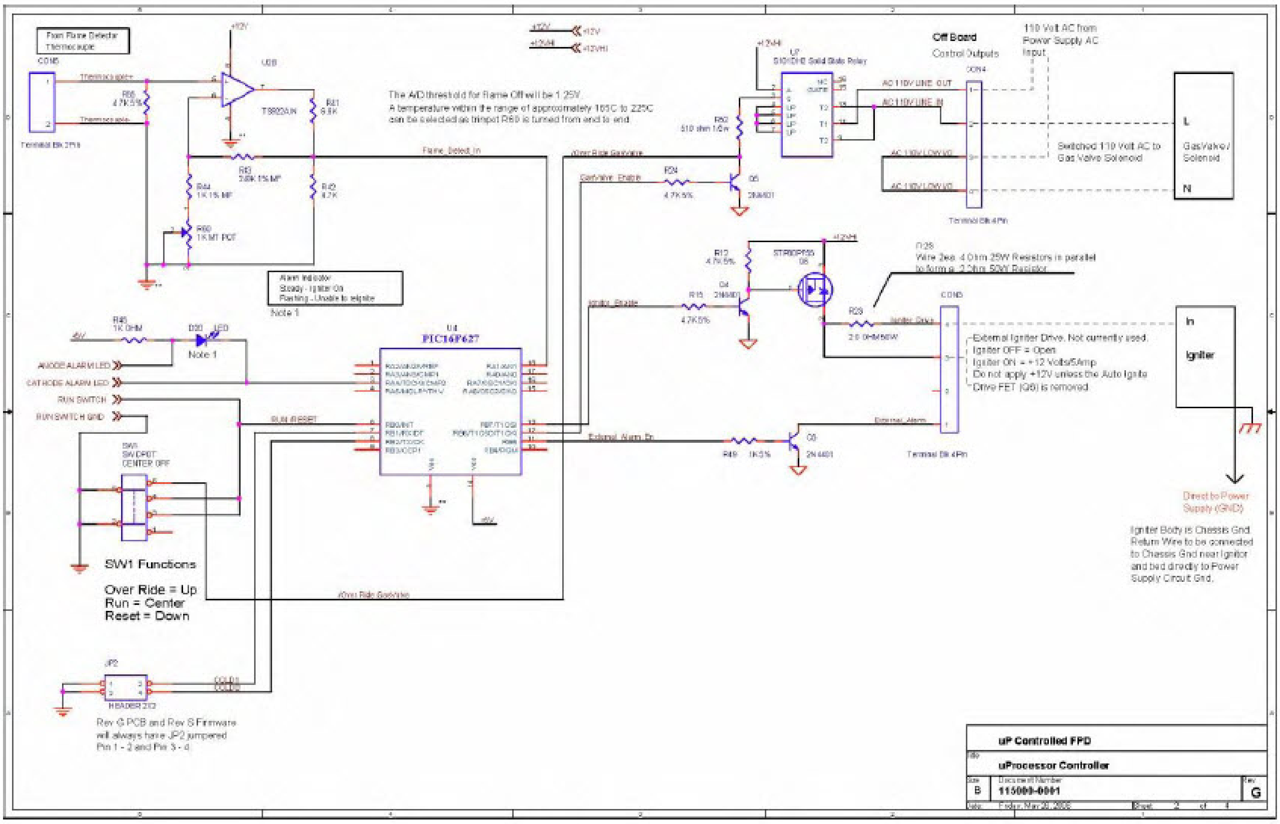


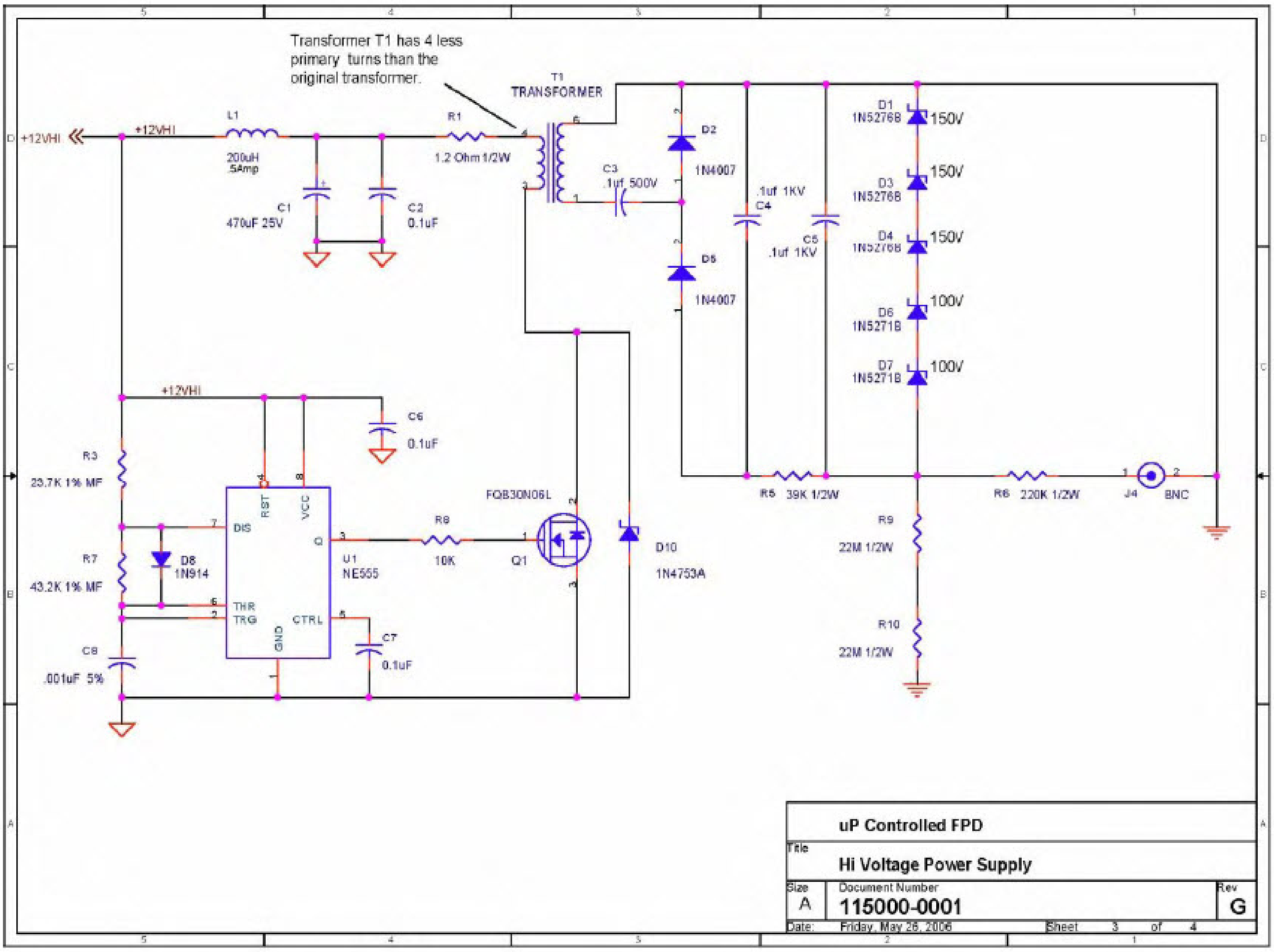
uP Controlled FPD Rev G Component Guide

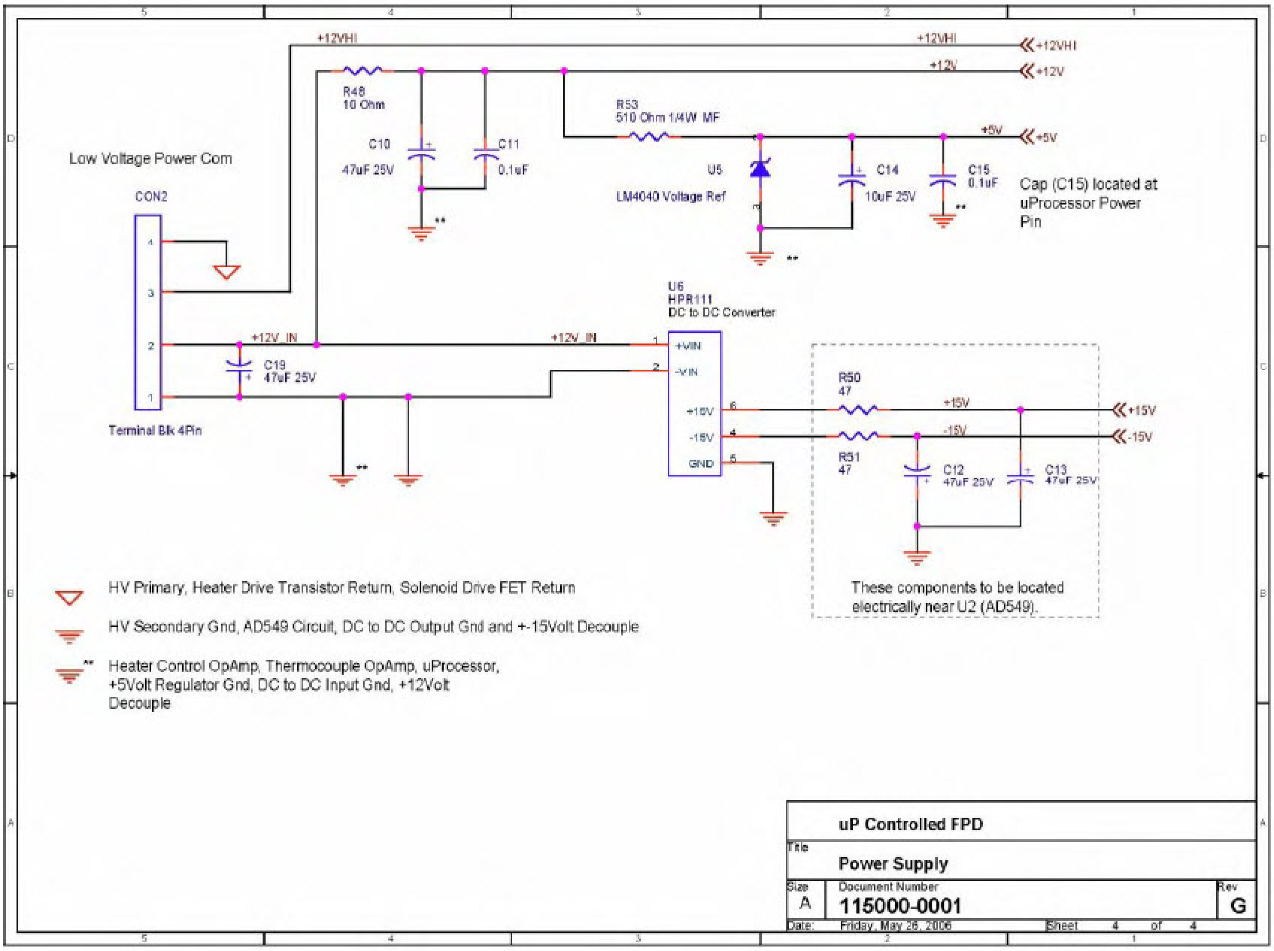


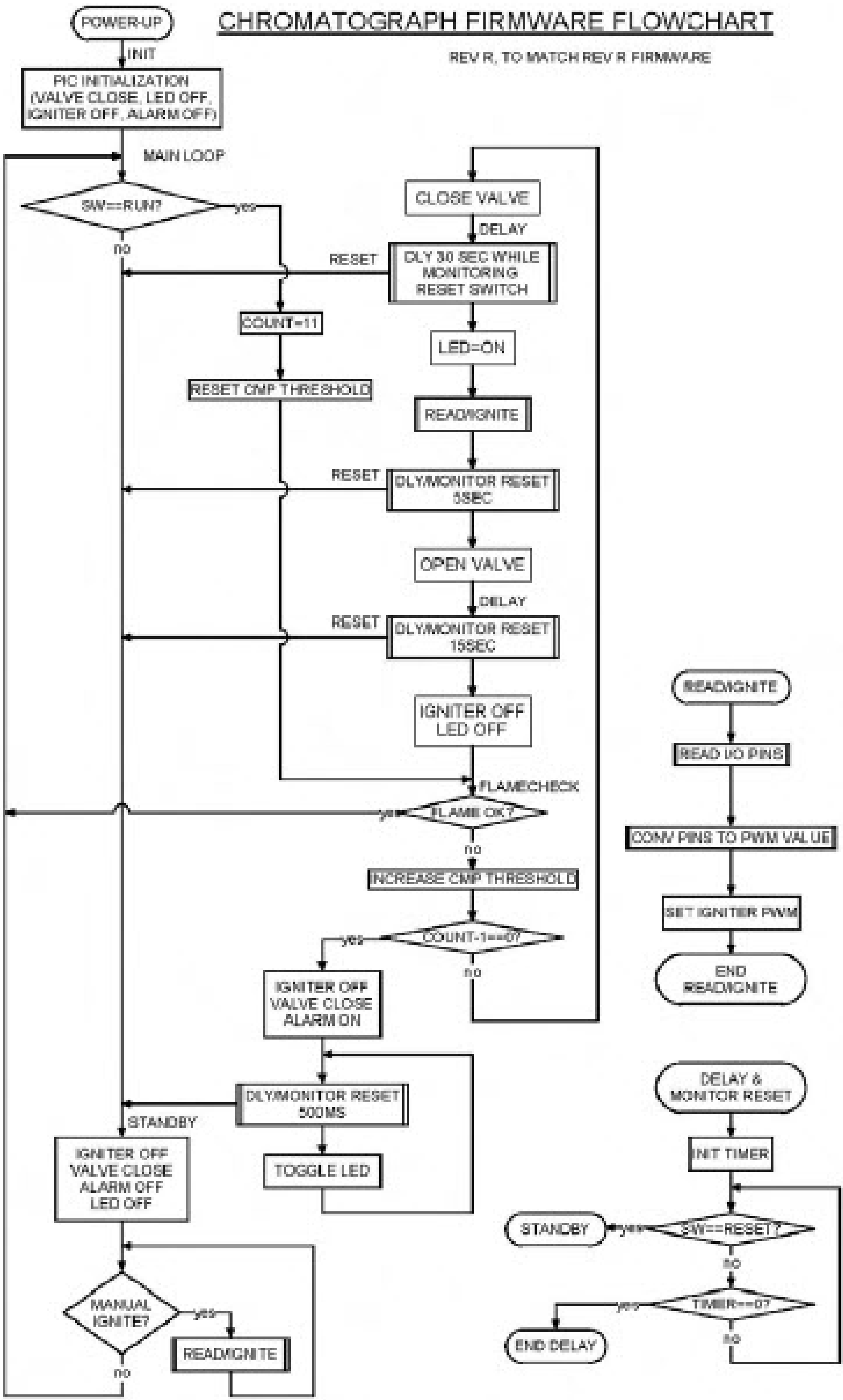
Control Outputs
Off Board
From 110 Volt AC
AC 110V LINE OUT
AC 110V LINE IN
AC 110V LOW I/O
AC 110V LOW I/O
IN
AC 110V LINE to Relay
OUT
AC 110V LINE From Relay
IN
AC 110V Neutral to Relay
OUT
AC110V Neutral From Relay
Gas Valve / Solenoid
L In
N In
Switched 110 Volt AC to Gas Valve Solenoid
CON4
Terminal Blk 4Pin
Control Signals From MicroProcessor
Igniter Body is Chassis Gnd.
Return Wire to be connected to Chassis Gnd near Ignitor and tied directly to Power Supply Circuit Gnd.
Igniter Drive
External Igniter Drive
External Alarm
Igniter
To Igniter Power In
Igniter
In
External Igniter Drive Input. Not currently used.
Igniter OFF = Open
Igniter ON = +12 Volts/6Amp
Do not apply +12V unless the Auto Ignite Drive FET (Q6) is removed.
Return Direct to Power Supply (GND)
ALARM
External Alarm Output.
CON3
Terminal Blk 4Pin
High Current Gnd
High Current +12V
Low Current +12V
Low Current Gnd
GND
12V
12V
GND
POWER SUPPLY
12V, 5A, 60W
Line, Neutral, and Chassis as indicated on the PS Input Pins
120V AC In
CON2
Terminal Blk 4Pin
RUN / RESET SWITCH
CATHODE ALARM LED
ANODE ALARM LED
RUN / RESET SWITCH GND
Direct Output 10V FS
1V FS Output
Recorder Common
Photo Detector Signals Out
SW1
LED C
LED A
SW COM
10V
1V
SIG COM
These signals can be used to remotely mount the PCB mounted Run/Reset Switch (SW1) and the LED Indicator (D30). Not currently used.
Output to Recorder
CON1
Terminal Blk 8Pin
Off Board
Control Signal / Power Supply Wiring Diagram
FPD uP Controlled Rev G


Heater Block
BNC Input Connector is mounted on a metal bracket
Components connected with Dash Lines are wired above the PCB and tied directly to the isolated teflon terminals or Relay Pins.
Photo Detector In
BNC_GND
Select Linear
Select Sq Root
SW3
CON1
Photo Detector Signal Out
Manual zero
ZERO
SW4
ON
OFF
uP Controlled FPD
Photo Detector Amp / FPD Option
115000-0001
G


PIC16F627
Off Board
Control Outputs
SW1 Functions
Over Ride = Up
Run = Center
Reset = Down
uP Controlled FPD
uProcessor Controller
115000-0001
G


Transformer T1 has 4 less primary turns than the original transformer.
T1 TRANSFORMER
+12VHI
L1 200uH .5Amp
C1 470uF 25V
C2 0.1uF
R1 1.2 Ohm 1/2W
C3 .1uf 500V
D2 1N4007
D5 1N4007
.1uf 1KV C4
C5 .1uf 1KV
D1 1N5276B 150V
D3 1N5276B 150V
D4 1N5276B 150V
D6 1N5271B 100V
D7 1N5271B 100V
C6 0.1uF
R3 23.7K 1% MF
R7 43.2K 1% MF
D8 1N914
C8 .001uF 5%
DIS RST VCC Q THR TRG CTRL GND
U1 NE555
C7 0.1uF
R8 10K
Q1
FQB30N06L
D10 1N4753A
R5 39K 1/2W
R6 220K 1/2W
J4 BNC
R9 22M 1/2W
R10 22M 1/2W
uP Controlled FPD
Title
Hi Voltage Power Supply
Size A
Document Number
115000-0001
Rev G
Date: Friday, May 26, 2006
Sheet 3 of 4


+12VHI
+12V
+5V
R48 10 Ohm
C10 47uF 25V
C11 0.1uF
R53 510 Ohm 1/4W MF
U5 LM4040 Voltage Ref
C14 10uF 25V
C15 0.1uF
Cap (C15) located at uProcessor Power Pin
Low Voltage Power Com
CON2
Terminal Blk 4Pin
+12V_IN
C19 47uF 25V
U6 HPR111 DC to DC Converter
+VIN -VIN +15V -15V GND
R50 47
R51 47
+15V
-15V
C12 47uF 25V
C13 47uF 25V
These components to be located electrically near U2 (AD549).
HV Primary, Heater Drive Transistor Return, Solenoid Drive FET Return
HV Secondary Gnd, AD549 Circuit, DC to DC Output Gnd and +-15Volt Decouple
Heater Control OpAmp, Thermocouple OpAmp, uProcessor, +5Volt Regulator Gnd, DC to DC Input Gnd, +12Volt Decouple
uP Controlled FPD
Title
Power Supply
Size A
Document Number
115000-0001
Rev G
Date: Friday, May 26, 2006
Sheet 4 of 4



CHROMATOGRAPH FIRMWARE FLOWCHART
REV R, TO MATCH REV R FIRMWARE
POWER-UP
INIT
PIC INITIALIZATION (VALVE CLOSE, LED OFF, IGNITER OFF, ALARM OFF)
MAIN LOOP
SW==RUN?
yes
no
CLOSE VALVE
DELAY
RESET
DLY 30 SEC WHILE MONITORING RESET SWITCH
COUNT=11
LED=ON
RESET CMP THRESHOLD
READ/IGNITE
RESET
DLY/MONITOR RESET 5SEC
OPEN VALVE
DELAY
RESET
DLY/MONITOR RESET 15SEC
IGNITER OFF LED OFF
FLAMECHECK
FLAME OK?
yes
no
INCREASE CMP THRESHOLD
COUNT-1==0?
yes
no
IGNITER OFF VALVE CLOSE ALARM ON
DLY/MONITOR RESET 500MS
STANDBY
TOGGLE LED
IGNITER OFF VALVE CLOSE ALARM OFF LED OFF
MANUAL IGNITE?
yes
no
READ/IGNITE
READ/IGNITE
READ I/O PINS
CONV PINS TO PWM VALUE
SET IGNITER PWM
END READ/IGNITE
DELAY & MONITOR RESET
INIT TIMER
STANDBY
yes
SW==RESET?
no
TIMER==0?
yes
no
END DELAY

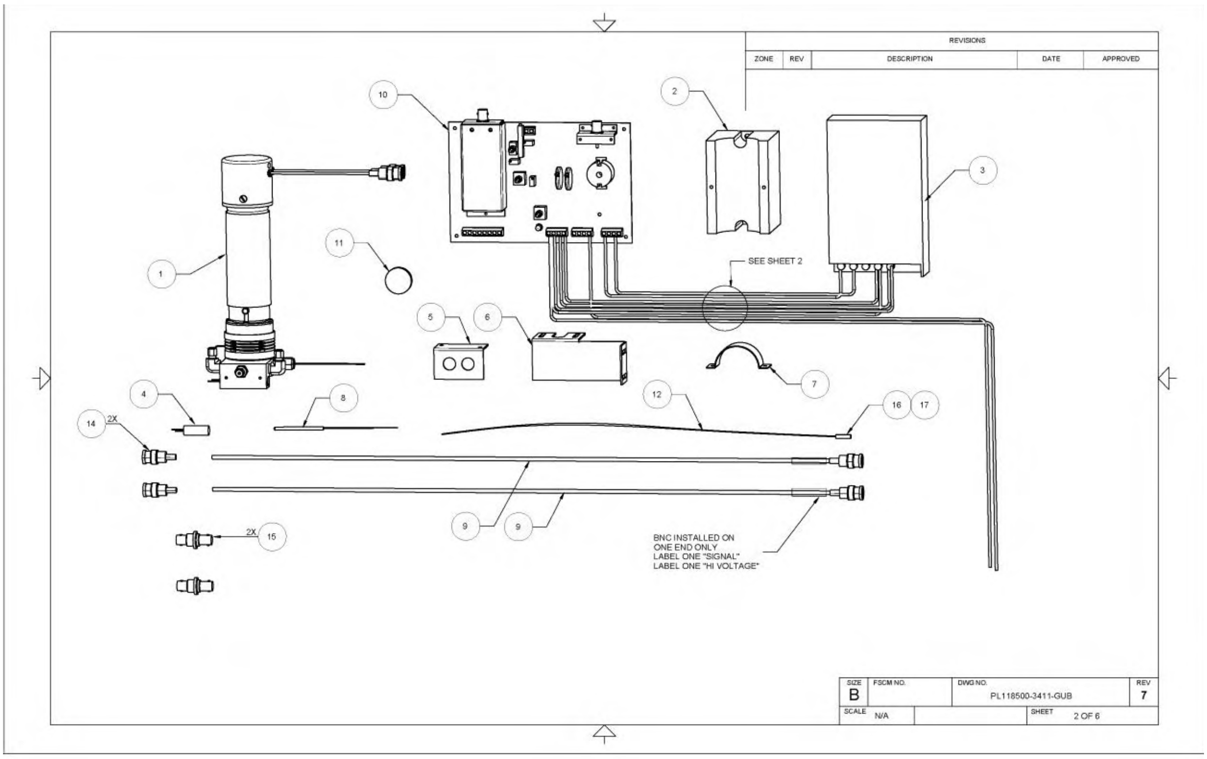
REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED

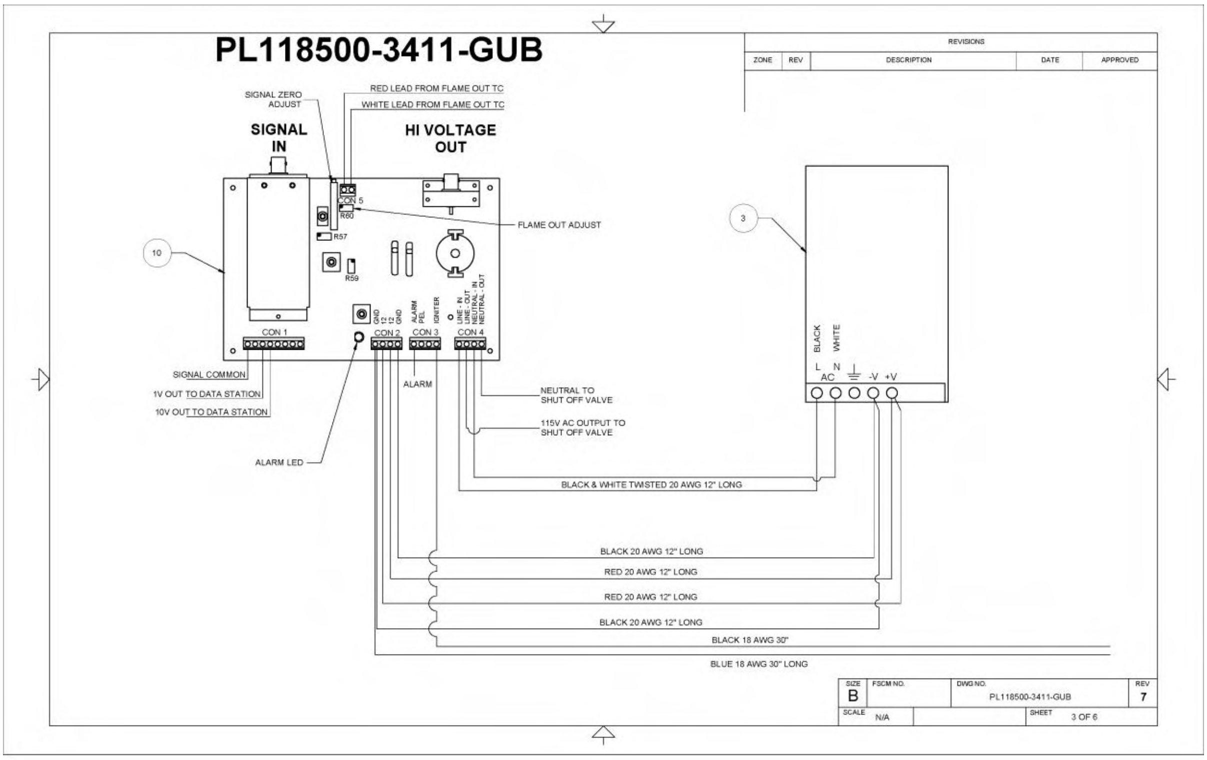
PL118500-3411-GUB

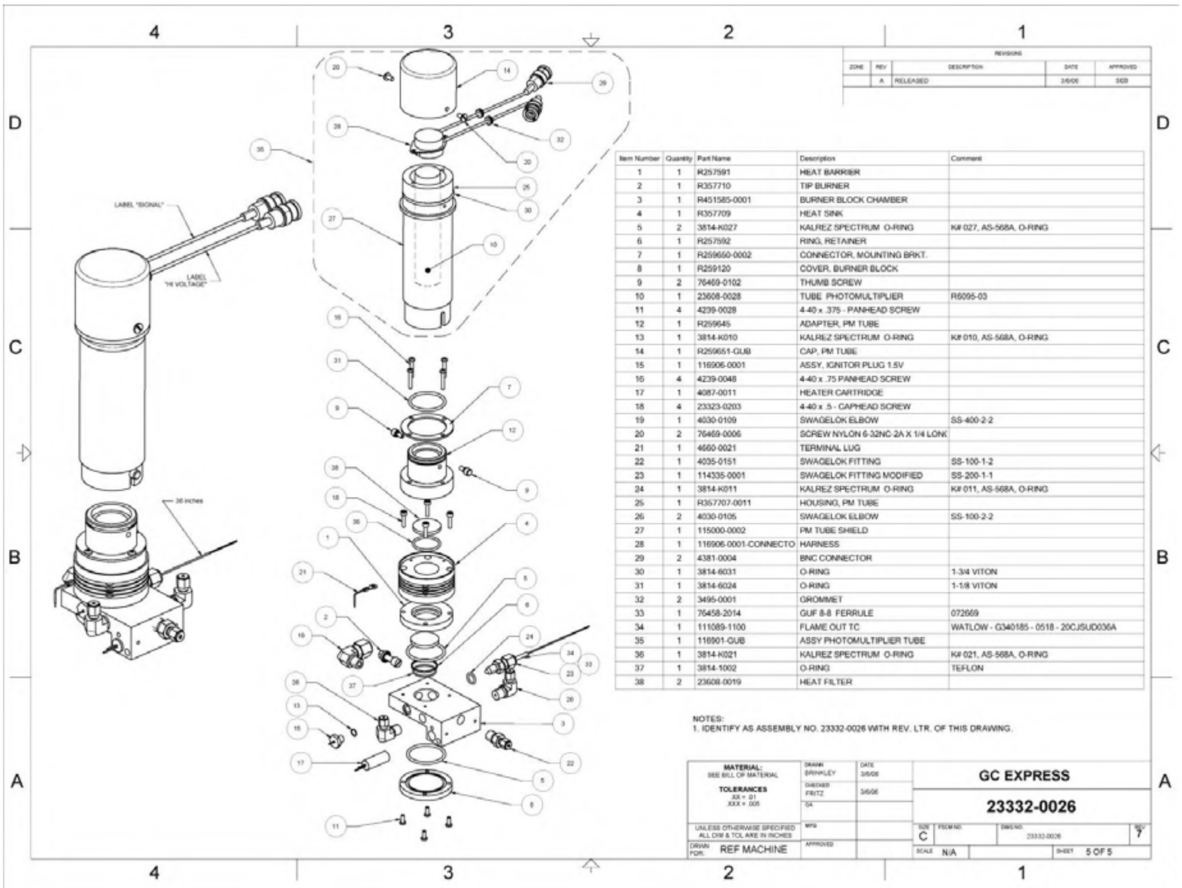
Item Number	Quantity	Part Number	Description	Revision	Comment
1	1	23332-0026	FPD		
2	1	115000-0001	PM TUBE CRADLE	C	
3	1	115000-0008	POWER SUPPLY	N/A	S-60-12
4	1	4087-0011	HEATER CARTRIDGE	N/A	
5	1	115000-0006	BNC BULKHEAD MOUNTING BRACKET 2	A	
6	1	115000-0005	BRACKET 1	B	
7	1	115000-0003	PM TUBE CLAMP	A	
8	1	111089-1100	FLAME OUT TC		WATLOW - G340185 - 0518 - 20CJSUD036A
9	2	COAX-25in-WBNC	25 inch COAX CABLE W/BNC CONN	N/A	BNC CONNECTOR # 4381-0004
10	1	115003-0001	PFD PCB GUB	A	
11	1	23608-0027	FILTER, OPTICAL 394 Mu SULFER		
12	1	WIRE 16in - 18 AWG BLUE	WIRE 16in - 18 AWG BLUE	N/A	IGNITER WIRE #17 & 18
13	1	WIRE-ASSY-118500-3411-GUB	WIRE ASSEMBLY FOR 118500-3411-GUB		SEE SHEET 2
14	4	4381-0004	BNC CONNECTOR		
15	2	Amphenol - 4525	FEMALE TO FEMALE	N/A	
16	1	76288-2002	AMP p/n 7-87499-2 Small Black Connector	N/A	
17	1	76495-0004	CONNECTOR, RECEPT RND, .032D	N/A	

NOTES:
1. IDENTIFY AS PARTS LIST 118500-3411-GUB WITH REV. LTR. OF THIS DRAWING.

DRAWN BRINKLEY	DATE 5/3/06	
CHECKED FRITZ	5/3/06	
QA		**FPD ASSEMBLY KIT**
MFG		SIZE B · FSCM NO. · DWG NO. PL118500-3411-GUB · REV 7
DRWN FOR: **REF MACHINE** · APPROVED		SCALE N/A · SHEET 1 OF 6



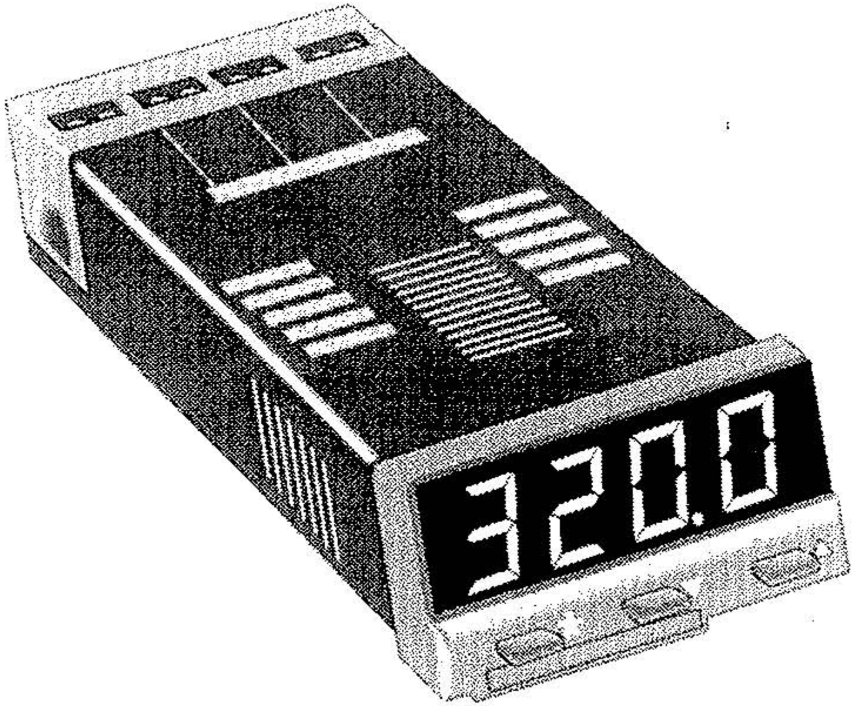




Item Number	Quantity	Part Name	Description	Comment
1	1	R257591	HEAT BARRIER	
2	1	R357710	TIP BURNER	
3	1	R451585-0001	BURNER BLOCK CHAMBER	
4	1	R357709	HEAT SINK	
5	2	3814-K027	KALREZ SPECTRUM O-RING	K# 027, AS-568A, O-RING
6	1	R257592	RING, RETAINER	
7	1	R259650-0002	CONNECTOR, MOUNTING BRKT.	
8	1	R259120	COVER, BURNER BLOCK	
9	2	76469-0102	THUMB SCREW	
10	1	23608-0028	TUBE PHOTOMULTIPLIER	R6095-03
11	4	4239-0028	4-40 x .375 - PANHEAD SCREW	
12	1	R259645	ADAPTER, PM TUBE	
13	1	3814-K010	KALREZ SPECTRUM O-RING	K# 010, AS-568A, O-RING
14	1	R259651-GUB	CAP, PM TUBE	
15	1	116906-0001	ASSY, IGNITOR PLUG 1.5V	
16	4	4239-0048	4-40 x .75 PANHEAD SCREW	
17	1	4087-0011	HEATER CARTRIDGE	
18	4	23323-0203	4-40 x .5 - CAPHEAD SCREW	
19	1	4030-0109	SWAGELOK ELBOW	SS-400-2-2
20	2	76469-0006	SCREW NYLON 6-32NC-2A X 1/4 LONG	
21	1	4660-0021	TERMINAL LUG	
22	1	4035-0151	SWAGELOK FITTING	SS-100-1-2
23	1	114335-0001	SWAGELOK FITTING MODIFIED	SS-200-1-1
24	1	3814-K011	KALREZ SPECTRUM O-RING	K# 011, AS-568A, O-RING
25	1	R357707-0011	HOUSING, PM TUBE	
26	2	4030-0105	SWAGELOK ELBOW	SS-100-2-2
27	1	115000-0002	PM TUBE SHIELD	
28	1	116906-0001-CONNECTO	HARNESS	
29	2	4381-0004	BNC CONNECTOR	
30	1	3814-6031	O-RING	1-3/4 VITON
31	1	3814-6024	O-RING	1-1/8 VITON
32	2	3495-0001	GROMMET	
33	1	76458-2014	GUF 8-8 FERRULE	072669
34	1	111089-1100	FLAME OUT TC	WATLOW - G340185 - 0518 - 20CJSUD036A
35	1	116901-GUB	ASSY PHOTOMULTIPLIER TUBE	
36	1	3814-K021	KALREZ SPECTRUM O-RING	K# 021, AS-568A, O-RING
37	1	3814-1002	O-RING	TEFLON
38	2	23608-0019	HEAT FILTER	

CE

User's Guide



OMEGA
An OMEGA Technologies Company

http://www.omega.com
e-mail: info@omega.com

CN132
Temperature/Process Controller

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OMEGA®

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Canada:	976 Bergar Laval (Quebec) H7L 5A1 Tel: (514) 856-6928 e-mail: canada@omega.com	FAX: (514) 856-6886

For immediate technical or application assistance:

USA and Canada:	Sales Service: 1-800-826-6342 / 1-800-TC-OMEGA℠ Customer Service: 1-800-622-2378 / 1-800-622-BEST℠ Engineering Service: 1-800-872-9436 / 1-800-USA-WHEN℠ TELEX: 996404 EASYLINK: 62968934 CABLE: OMEGA	
Mexico and Latin America:	Tel: (95) 800-TC-OMEGA℠ En Español: (203) 359-1660 ext: 2203	FAX: (95) 203-359-7807 e-mail: espanol@omega.com

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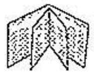
France:	9, rue Denis Papin, 78190 Trappes Tel: (33) 130-621-400 Toll Free in France: 0800-4-06342 e-mail: france@omega.com	FAX: (33) 130-699-120
Germany/Austria:	Daimlerstrasse 26, D-75392 Deckenpfronn, Germany Tel: 49 (07056) 3017 Toll Free in Germany: 0130 11 21 66 e-mail: germany@omega.com	FAX: 49 (07056) 8540
United Kingdom: ISO 9002 Certified	25 Swannington Road, Broughton Astley, Leicestershire, LE9 6TU, England Tel: 44 (1455) 285520 FAX: 44 (1455) 283912	P.O. Box 7, Omega Drive, Irlam, Manchester, M44 5EX, England Tel: 44 (161) 777-6611 FAX: 44 (161) 777-6622

Toll Free in England: 0800-488-488
e-mail: uk@omega.com

CN132 AUTOTUNE TEMPERATURE CONTROLLER OPERATOR'S MANUAL

Thank you for choosing the CN132... a new concept in advanced, full feature, compact temperature control. Please . . .

1.  **SCAN** the table of contents and look through the manual. Note sections of interest.
2. **REVIEW** the important safety information in Section 1 before installation.
3.  **INSTALL & CONNECT** using the instructions in Sections 4 and 5
4.  **SET UP** using the format you prefer...

-  Detailed step-by-step instructions (see Section 6), or...
-  Quick instructions for those familiar with micro-processor based controllers (see section 3).

UNPACKING INSTRUCTIONS

Remove the Packing List and verify that you have received all equipment. If you have any questions about the shipment, please call the OMEGA Customer Service Department at 1-800-622-2378 or (203) 359-1660.

When you receive the shipment, inspect the container and equipment for any signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

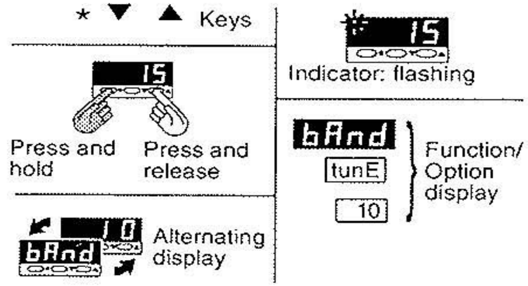
NOTE: The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

TABLE OF CONTENTS

SECTION 1. SAFETY

1. **INSTALLATION.** Designed for use:
   UL873 - only in products where the acceptability is determined by Underwriters Laboratories Inc.
   EN61010 - 1 within Installation Categories II and III environment and pollution degree 2.
   To avoid possible shock hazard install in a grounded metal enclosure. The sensor sheath and all accessible conductive parts should be grounded. Prevent live parts from being touched. Follow wiring diagrams and the appropriate regulations.
2. **CONFIGURATION:**
   All functions are front key selectable. It is the responsibility of the installing engineer to ensure that the configuration is safe. Use the program lock to protect critical functions from tampering.
   3.ULTIMATE SAFETY ALARMS: Normal safety advice:
   Do not use SP2 as the sole alarm where personal injury or damage may be caused by equipment failure.

SYMBOLS USED IN THIS MANUAL:



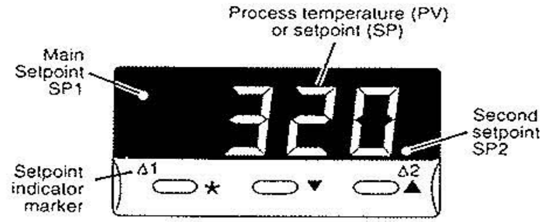
IN BRIEF . . .

Routine adjustments:

*	View setpoint
* ▲	Increase setpoint
* ▼	Decrease setpoint

To reset alarm or fault message:

▼ ▲ Momentarily press together



1

SECTION 2 FUNCTIONS MENU AND PROGRAM MODE GUIDE

1. **Enter/Exit:**

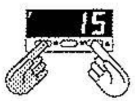
Program mode .Press and hold ▼ ▲ 3 sec.

2. **Single level navigation:**

3. **View/Change Option:**

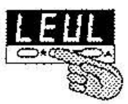
View Function/Option.

Autotune Option value.

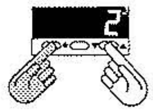


Change Option value (or press ✱ ▼). Release: check for correct selection.

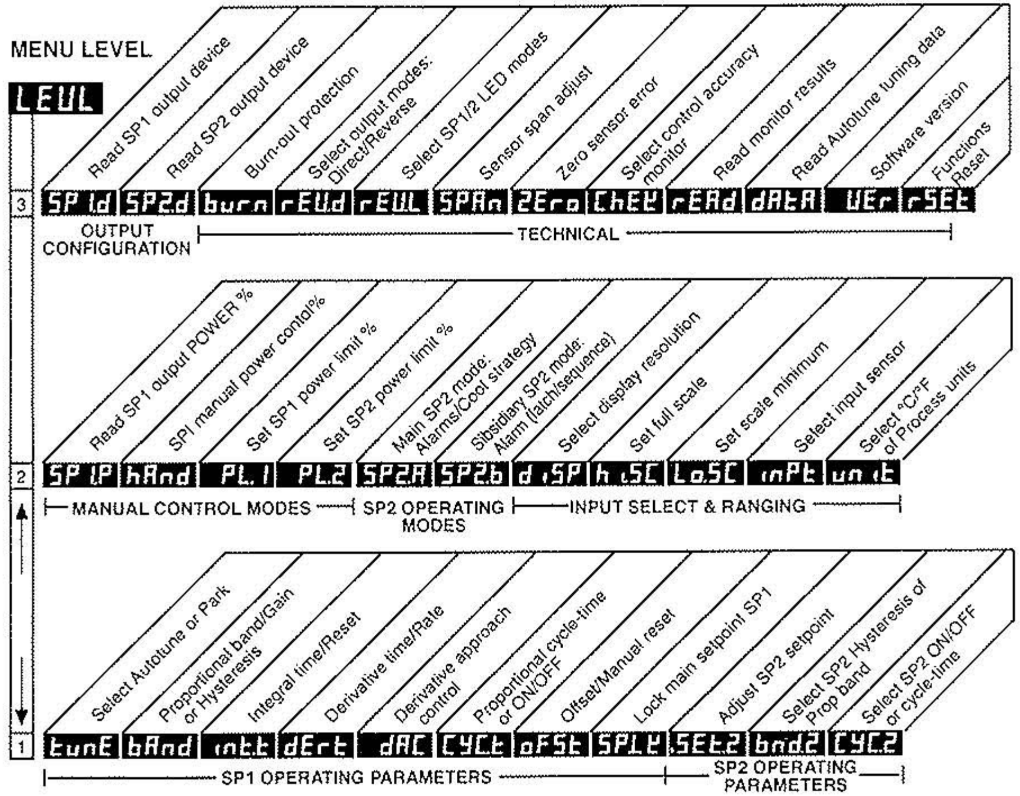
4. **Changing menu levels:**



Locate level Function.



Select new level.



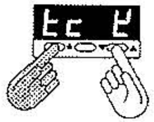
SECTION 3 QUICK SETUP INSTRUCTIONS

For full instructions, see Section 6.

1. **Power up.**

Alternating display after self-test

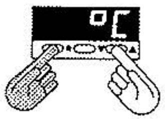
2. **Select input sensor.**



To select, press and hold ✱
Press ▲
Check for correct selection.

3. **Select °C/°F.**

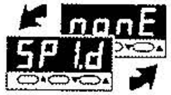
Press once...

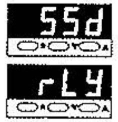


...to select.

4. **Select main setpoint output device.**

See Section 5.3.
Press once.

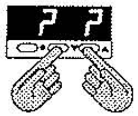




Select SSR drive or 2A relay.

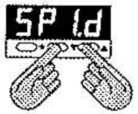
IMPORTANT: check that correct device is selected.

For any difficulty in initial configuration:



Press and hold ▼ ▲ 3 sec.
To display the next step, release keys together.

5. **Enter initial configuration.**



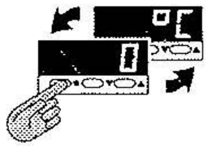
Hold both for 3 sec.

Normal operating mode:
No setpoint entered yet.

6. **Select other functions now or later.**

See guide and menu in Section 2.

7. **Setpoint display/adjust:**



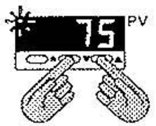
Display setpoint.

To increase setpoint...

To decrease setpoint...

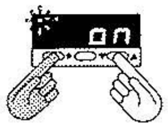
Operational with factory PID settings.

8. **To Autotune:**

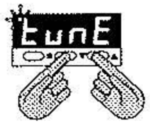


Enter program mode.
Hold both for 3 sec.

Entry point...



Select tunE/on



Exit program mode.
Hold both for 3 sec.

Display during Autotune...

NOTE: Setpoint is locked during Autotune. tunE/oFF to adjust.

9. **For optimum cycle-time:**

See Section 9.4.

SECTION 4 MECHANICAL INSTALLATION

1. Prepare a 1/32 DIN panel cutout:
   45.0mm +0.6/-0 x 22.2mm + 0.3/-0
   1.77" +0.02/-0 x 0.87" +0.01/-0
2. Unplug connector now if wiring separately.
   Unlock connector by sliding the green lock outward as shown in 4.2
3. Slide the controller into the cutout.
4. Slide the panel clamp on to the controller and press it firmly against the panel.
   NOTE: To remove the panel clamp, press in the two side levers.
5. Refit the connector if removed. To further secure the connector, slide the green lock inward as shown.

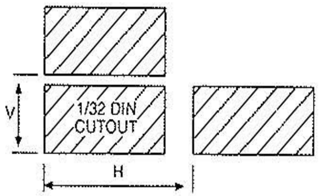
4.1 CN132 CONTROLLER PROTECTION RATING

The CN132 controller front of panel assembly is rated NEMA 4X/1P65 provided that:

- The panel is smooth, and cutout accurate
- The panel clamp is pressed firmly against the panel, ensuring that the clamp springs are fully compressed

4

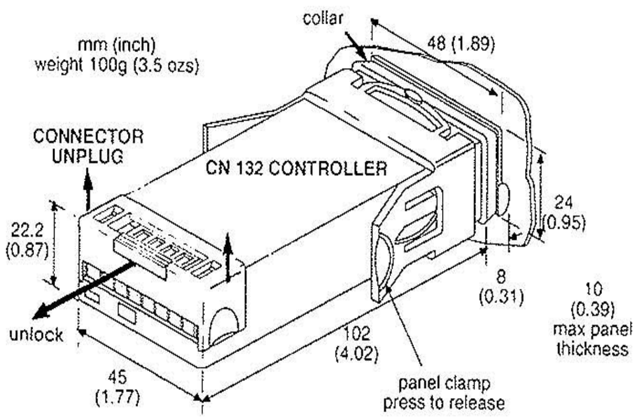
4.2 MULTIPLE CN132 INSTALLATIONS



Spacing Guide:

	V	H
Allows clamp/connector removal*	35 mm (1.38 in)	70 mm (2.76 in)
Minimum	30 mm (1.18 in)	60 mm (2.36 in)
Allows clamp removal	30 mm (1.18 in)	70 mm (2.76 in)

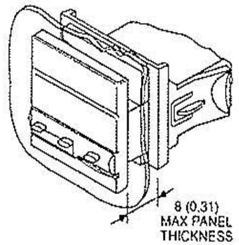
*Recommended



4.3 OPTIONAL 1/16 DIN PANEL ADAPTERS

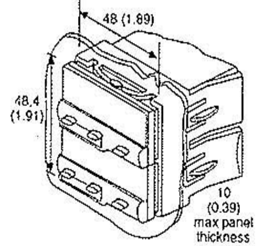
Adapter 48 mm (1.89 in) square enables CN132(s) to be mounted in a 1/16 DIN cutout.

- **1/16 DIN CN132 adapter** accepts one CN132.
  1. Remove collar/gasket from CN132, grip firmly and pull off.
  2. Assemble adapter halves either side of panel and locate pegs.
  3. Slide CN132 into adapter, fit panel clamp, and press firmly against adapter.



1/16 DIN PANEL CUTOUT
45 X 45 +0.6/–0 mm
(1.77 X 1.77 +0.02/–0 in)

- **1/16 DIN CN132 Twin adapter** accepts two CN132s.
  1. Remove collars from both CN132s.
  2. Fit special collars included with twin panel clamp.
  3. Slide both CN132s into cutout. Fit twin panel clamp and press firmly against panel.



PANEL CUTOUT
45 X 46.2 +0.6/–0 mm
(1.77 X 1.82 +0.02/–04 in)

Panel adapters are not NEMA 4X/IP66 rated.

SECTION 5 ELECTRICAL INSTALLATION

⚠ CAUTION RISK OF ELECTRICAL SHOCK

1. Supply Voltage: 100-240V 50-60 Hz±10% 3VA
   12V or 24V (AC/DC)±20% 3VA Polarity not required
2. **Output devices (two)**
   Solid state relay drive SSd

   5 Vdc +0/−15%, 10mA non-isolated
   To switch a remote SSR (or logic)

   Miniature power relay rLY

   2A/250V~ resistive, Form A/SPST contacts

3. **Output device allocation:**

Either the SSd or the relay may be chosen as the output device for the main setpoint SP1. The remaining device is automatically allocated to the second setpoint SP2. Choose the most suitable output device arrangement for the application, and wire accordingly.

4. **Wiring the 8-way connector:**

Maximum recommended wire: 32/ 0.2 mm 1.0 mm² (18AWG 0.04"²). Prepare cables carefully, avoid bridging and excessive cable strain on the connector.

5. **Switching inductive loads with the relay:**

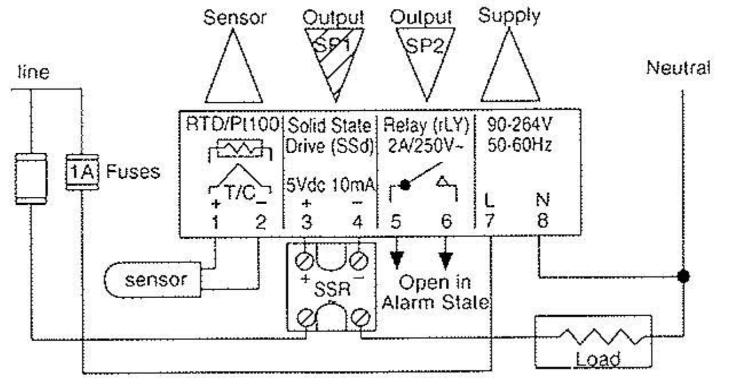
To prolong contact life and suppress interference, it is good engineering practice to fit a snubber (0.1µf/100Ω). See Example B.

CAUTION: Snubber leakage current can cause some electro-mechanical devices to be held ON. Check manufacturer's specification.

6

Example A

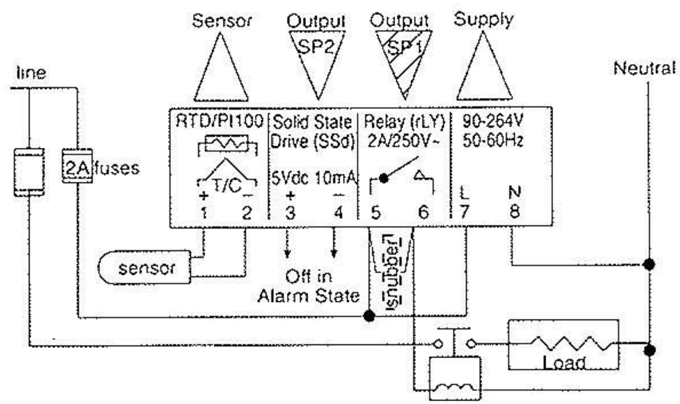
The SSd output is allocated to SP1 and wired to switch the load (heater) using an SSR.



NOTE: for optional 12 or 24V ac/dc models use terminals 7 & 8. Polarity not required.

Example B

The relay output is allocated to SP1 and wired to switch the load (heater) using a contactor.



SECTION 6 INITIAL SET UP

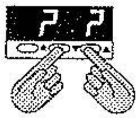
6.1 OVERVIEW

Follow three steps from initial power-up to accurately tuned control.

1. **Gather details for initial configuration:**
   1. The temperature sensor being used (thermocouple or RTD/Pt100)
   2. °C or °F
   3. Choice of controller output device for the main setpoint SP1, either:
      - Solid state relay drive SSd
      - Miniature power relay rLY
   4. Select any additional controller functions, e.g., SP2 Alarms, now or later.
2. **Set the required temperature.**

   The controller is now operational with factory PID settings.
3. **Tune the CN132 precisely to the application:**
   - Run the Autotune program. See Section 7. This automatically adjusts the PID control parameters to the characteristics of the application.

     Or...
   - Enter PID values manually, where the optimum values are already known.



NOTE: For any difficulty in initial configuration, press and hold ▼ ▲ 3 sec. To display the next step, release keys together.

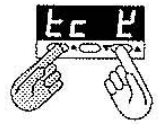
6.2 INITIAL CONFIGURATION

1. **Power up.**

Self test sequence (and brief display blanking)

The alternating display shows that no input sensor is selected and that one is required.

2. **Enter the input sensor type.**



Press and hold ✱
Press ▲ to select the sensor, e.g., "K".
Press ▼ to reverse indexing.

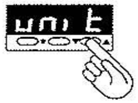
a. **Input sensor options**
See also Section 16.2.10.

	sensor type	mnemonic	sensor type	mnemonic
Thermocouples	B	tc b	N	tc n
	E	tc E	R	tc r
	J	tc J	S	tc S
	K	tc K	T	tc t
	L	tc L		
Resistance Thermometer	RTD-2 / Pt100	rtd		

b. **Linear process inputs**
See Section 16.2.10.

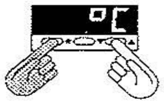
After selection, release ✱. Check that the selection is correct.

3. **To select display in °C or °F:**



Press ▲ once.

The display shows that no display unit is selected.



To select °C or °F (Bar, PSI, pH, Rh) press and hold ✱. Press ▲ to select °C, °F, etc. Release ✱.

Check that the display alternating with [unit] is correct.

4. **To allocate SP1 - main setpoint output device:**

Press ▲ once.

The display shows that no output device has been allocated to SPI.

Available SP1 output devices:

Solid state relay drive

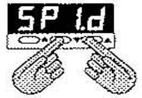
Miniature power relay

The remaining output device is automatically allocated to SP2.

To select SP1 output device, press and hold ✱. Press ▲ to select.

IMPORTANT: Check that correct device is selected. Once entered in memory, it is changeable only on full reset. See Section 16.3.12.

5. **Enter the initial configuration into the controllers memory.**



Press and hold both ▼ and ▲ for 3 sec (display may differ).

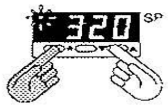
Process temperature is displayed. Ambient 23°C and [PArk] alternate, as no setpoint is yet selected.

6. **Display setpoint.**

Press and hold ✱

[°C/0] or [°F/32] alternate

7. **Adjust setpoint.**



Press and hold ✱
Press ▲ to increase, ▼ to decrease. Flashing LED shows SP1 output ON. The temperature rises.

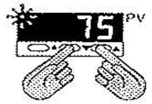
Controller is operational with factory PID settings:

Proportional band/Gain	10°C/18°F	Integral time/Reset	5 mins
Proportional cycle-time	20 secs	Derivative time/Rate	25 secs
DAC Derivative approach control	1.5		

SECTION 7 AUTOTUNE

7.1 TO USE AUTOTUNE - TUNE PROGRAM

1. **For best results:**
   - Start with the load cool.
   - Set the usual setpoint temperature and use normal load conditions.
2. **Enter program mode.**

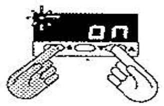


Press and hold both ▼ ▲ for 3 sec.

Release together when [tunE] is displayed on entry to program mode. If display differs, see Section 2 for functions menu.

Press ▼ or ▲ to locate [tunE]

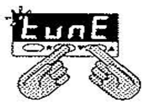
3. **Select** [tunE/on]



Press and hold *
Press ▲ once.

Release *

4. **Start TUNE program.**

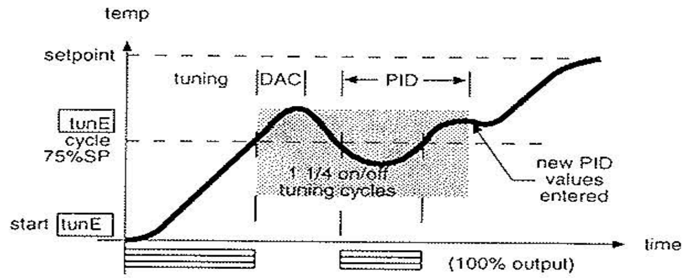


Press and hold both ▼ ▲ for 3 sec. To exit program mode starting [tunE] (display may differ) release ▼ ▲

Display during [tunE] program...
NOTE: Setpoint is locked during [tunE] To adjust, select [tunE/oFF]

TUNE program is complete. Alternating display stops. New PID values are entered automatically.

Process temperature climbs to setpoint.



The AUTOTUNE - Tune Program

9

7.2 MORE ON AUTOTUNE

• **Operation**

Autotune "teaches" the controller the main characteristics of the process. For best results, run Autotune at the usual setpoint temperature under normal load conditions.

Autotune "learns" by cycling the output on and off. The results are measured and used to calculate optimum PID values which are automatically entered in the controller memory.

PID Parameters tuned:

- Proportional band/Gain
- Proportional cycle-time (requires you to manually accept it unless pre-selected; see Section 9)
- Integral time/Reset
- Derivative time/Rate
- Derivative Approach Control (DAC)

Two alternative forms of Autotune are provided, TUNE and TUNE AT SETPOINT. Each is described on the following pages.

• **The Autotune - TUNE program**

To run TUNE select [tunE/on]. See Section 7.1. Start with the load cool. The output is cycled at 75% of the setpoint value to avoid any overshoot during the tuning cycle. The warm-up characteristics are monitored to set DAC which minimizes overshoot on subsequent warm-ups.

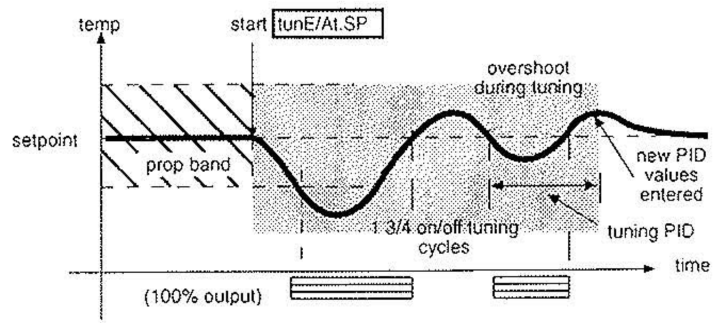
• **The Autotune - TUNE AT SETPOINT program**

To run TUNE AT SETPOINT select [tunE/At.SP]. See Section 7.1.3: Press ▲ 3 times. The tuning cycle occurs at **setpoint** and, in some applications, may give better results. See examples below:

The TUNE AT SETPOINT program is recommended:

- When the setpoint is below 100°C/200°F, where TUNE's tuning cycle at 75% setpoint may be too close to ambient to produce good results.
- When the process is already hot and the cooling rate is slow
- When controlling multi-zone or heat-cool applications
- To re-tune if the setpoint is changed substantially from the previous Autotune

NOTE: DAC is not re-tuned by Tune at Setpoint.



The Autotune - TUNE AT SETPOINT Program

SECTION 8 VIEWING AND SELECTING FUNCTIONS

8.1 FUNCTIONS AND OPTIONS

Select the functions of the CN132 from the multi-level menu using program mode.

- For menu of main Functions, see Section 2.
- For Functions and Options list, see Section 16.

- **Definitions:**

Functions (Fn): The actions the controller can perform

Options (Opt): The available values for a function

Example:

Function: Proportional band

Option: 15°C/°F selected

Short reference: bAnd/15 (Fn/Opt)

- **Control during programming:**

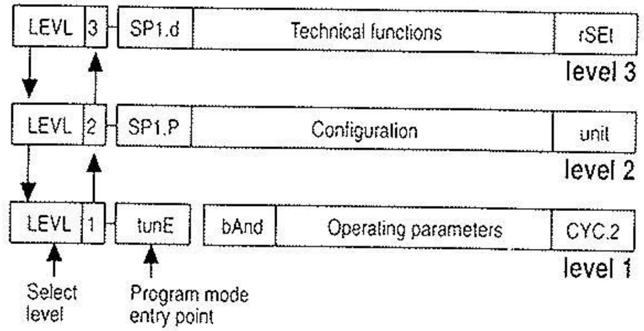
Control with existing settings is maintained during programming. Control with new instructions begins only on exiting program mode, when the controller memory is updated.

- **Hints when using program mode:**

Some options will not adjust! The lock may have been applied. All functions and current options may be viewed even when locked.

Program mode auto-exit: Normal operation is restored, and new instructions entered, if there is no key activity for 60 sec when in program mode (to disable, see Section 14).

- **The multi-level Function and Option menu:**



For menu of main Functions, see Section 2.

8.2 USING PROGRAM MODE

1. **To enter program mode from normal operating mode:**

Press and hold both ▼ ▲ for 3 sec.

Enter program mode at tunE Function on level 1, see diagram on previous page. Release both ▼ ▲ together.

2. **To exit program mode at any time returning to normal operating mode:**

Press and hold both ▼ ▲ for 3 sec.

NOTE: Control begins with any new instructions now entered in memory.

3. **To view Functions on the same level:**

Press ▼ or ▲ once to view the next Function.

Or...

Hold ▼ or ▲ to auto-index through the Functions.

4. **To display the current Option value for a Function:**

On release of ▼ or ▲, Option alternates with the Function:

Function [bAND]

Option [10] °

5. **Autotune Option values:**

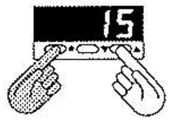
Autotune calculated value indicator

If a manual Option is selected, the Autotune value is retained in memory.

6. **To change an Option value or setting:**

Index to the required Function, e.g., [bAnd], press and hold ✱.

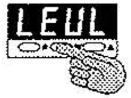
Current Option displayed: [10] °



Press ▲ to increase/▼ to decrease, e.g., [bAnd] increased to [15] °. Release ✱

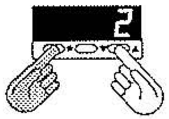
IMPORTANT: Check the new Option value **before** moving to another Function or exiting program mode.

7. **To change menu levels:**



Press and hold ▼ to reach the level selection function.

Release ▼ to display the current level [1]



Press and hold ✱
Press ▲ to increase level (2) or press ▼ to decrease level.

Release ▲ to display the new level [2]

REMINDER: Use ▼ and ▲ to locate Functions on each level. To exit program mode and return to normal operation, press and hold both ▼ ▲ 3 sec or auto-exit program mode after 60 sec of inactivity.

SECTION 9 PROPORTIONAL CYCLE-TIME

Optimum cycle-time is calculated by Autotune TUNE or TUNE AT SETPOINT programs, but not automatically implemented.

The choice of cycle-time is influenced by the external switching device or load, e.g., contactor, SSR, valve.

9.1 ALTERNATIVE CYCLE-TIME SELECTION METHODS

See the instructions opposite:

1. Run Autotune. On completion, check the calculated cycle-time. See Section 9.4.
   - Accept,

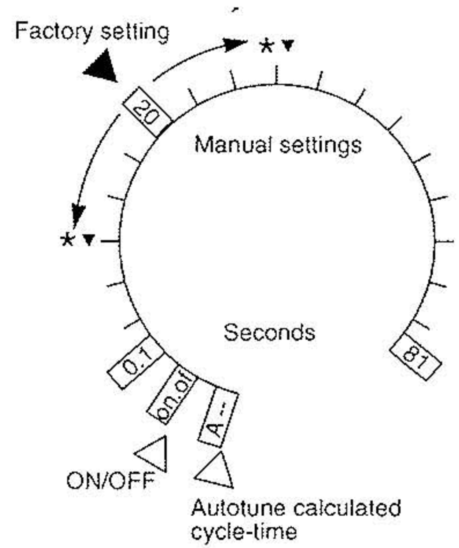
     Or...
   - Select nearest suitable value (20 sec factory setting applies unless replaced)
2. Pre-select automatic acceptance of any calculated Autotune cycle-time. See Section 9.5.
3. Manually pre-select any cycle-time between 0.1 and 81 sec. This will not be changed. See Section 9.6.
4. To use the 20 sec factory set cycle-time, no action is needed whether Autotune is used or not.

NOTE: When an Autotuned cycle-time [A XX] has been accepted, it is automatically updated on each subsequent Autotune.

IF IN DOUBT, USE METHOD 1, ABOVE.

9.2 CYC.T CYCLE-TIME SETTINGS

Analog representation:



9.3 CYCLE-TIME RECOMMENDATIONS

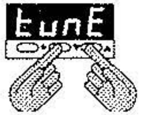
To avoid premature relay failure:

Output device	Cycle-time	Load (resistive)
Internal relay [rLY]	**20 sec or more**	
	Recommended	2A/250V~
	10 sec minimum	
	5 sec minimum	1A/250V~
Solid state	1–3 sec	SSR
drive [SSd]	0.1 sec	Logic/PIM

9.4 TO SELECT AUTOTUNE CALCULATED CYCLE-TIME:

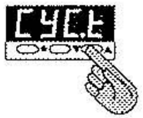
On completion of Autotune:

1. **Enter program mode.**



Press and hold both ▼ ▲ for 3 sec.

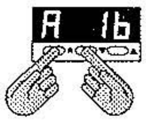
2. **Index to cycle-time Function.**



Press and hold ▲

Release ▲; 20 sec factory setting is displayed.

3. **View calculated optimum cycle-time.**



Press and hold ▲. Then press and hold ▼ until indexing stops; e.g., calculated cycle-time is 16 sec. If suitable, proceed to step 5, below.

4. **Manually select more suitable cycle-time.**

If the calculated value is not compatible with the switching device, e.g., 30 sec more suits a contactor, press and hold ✱. Press ▲

5. **Enter the cycle-time in memory.**

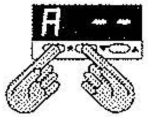
Press and hold both ▼ ▲ for 3 sec to exit program mode and implement the new instructions.

9.5 TO PRE-SELECT AUTOMATIC ACCEPTANCE OF ANY AUTOTUNE CYCLE-TIME:

1. **Before Autotune is selected:**

   Enter program mode, index to cycle-time Function [CYC.t]. See Section 9.4.

2. **Select Autotune calculated cycle time.**



Press and hold ✱. Then press and hold ▼ until indexing stops.

[A --] Shows no Autotune cycle-time yet exists.

3. **Autotune [tunE/on../At.SP] must be selected now, BEFORE exiting program mode.**

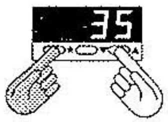
Press and hold ▼ to [tunE] Function.

9.6 TO PRE-SELECT CYCLE-TIME BEFORE AUTOTUNE

1. **Before Autotune is selected:**

   Enter program mode. Index to cycle-time Function [CYC.t]. See Section 9.4.

2. **Select preferred value.**



Press and hold ✱
Then press ▲ to increase (35 sec) or ▼ to decrease.

3. **Exit program mode or index to another function.**

   See Section 9.4, step 5,

SECTION 10 USING THE SECOND SETPOINT - SP2

10.1 TO CONFIGURE SP2 AS AN ALARM:

1. Select the main SP2 operating mode in [SP2.A]. See Section 10.4.
2. If required, select a subsidiary SP2 mode in [SP2.b]. See Section 10.5.
3. If the factory set 2.0°C/3.6°F hysteresis is unsuitable, change in [bnd.2]. Set [CYC.2] ON/OFF (factory setting).
4. Adjust SP2 setpoint in [SEt.2] (to set y° in 10.4).
5. Exit program mode — SP2 is now operational as an alarm.

10.2 TO CONFIGURE SP2 AS A PROPORTIONAL CONTROL OUTPUT:

1. Select the main operating mode in [SP2.A]. See Section 10.4.
2. Select SP2 proportional band in [bnd.2] and SP2 cycle-time in [CYC.2]
3. Adjust SP2 setpoint in [SEt.2] (to set y° in 10.4).
4. Exit program mode - SP2 is now operational as a control output with time proportioning control action.

10.3 SP2 IN COOL STRATEGY

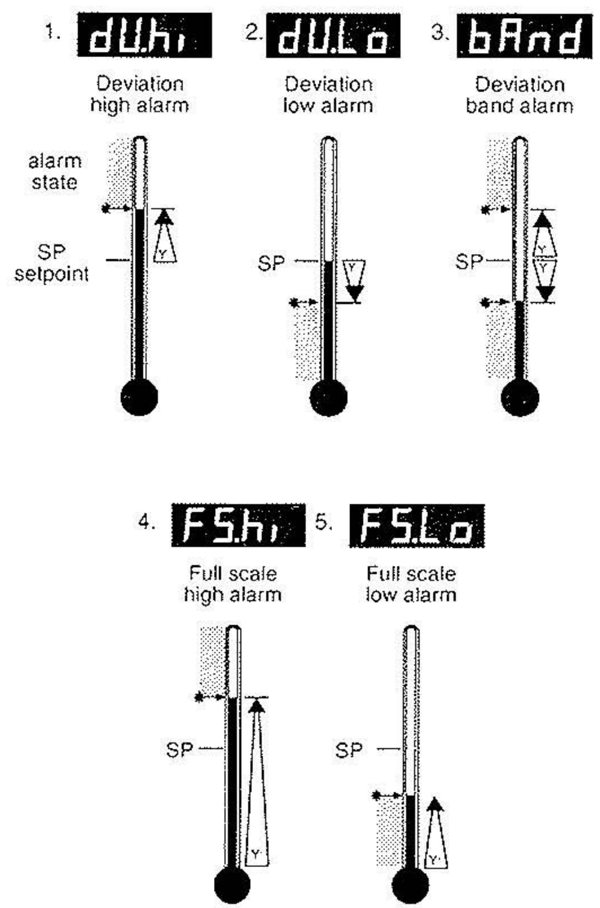
Cool strategy Options:

[CooL] in [SP2.A] (Selects cool strategy)

[nLin] in [SP2.b] (Non-linear proportional band)

10.4 SP2.A MAIN SP2 OPERATING MODE: ALARMS OR COOL STRATEGY

Factory setting nonE



10.5 SP2b SUBSIDIARY SP2 MODE: LATCH/ SEQUENCE OR NON-LINEAR COOL

Factory setting nonE

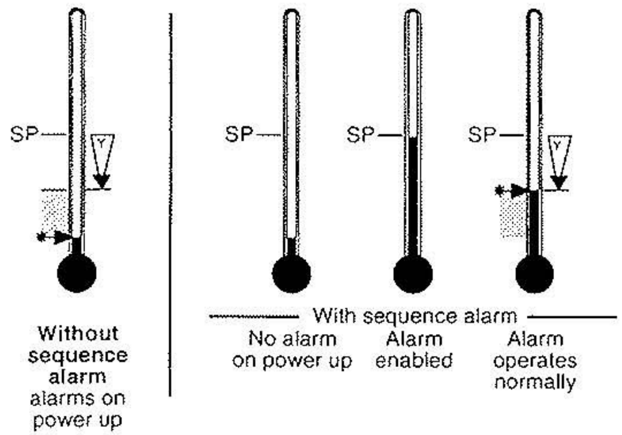
1. LtCh Latch alarm

When selected, the alarm output and indicator latch. To reset, when the alarm condition has been cleared, momentarily press ▼ ▲ together.

2. hoLd Sequence alarm

When selected, in any alarm mode, prevents an alarm on power up. The alarm is enabled only when the process temperature reaches setpoint.

Example: Sequence alarm used with deviation low alarm — dV.Lo



3. Ltho Latch and sequence alarm

10.6 SP2 OUTPUT AND LED INDICATOR STATES IN ALARM CONDITION

ALARM TYPE	ON-OFF OPERATING MODE: SP2 Output state	ON-OFF OPERATING MODE: SP2 LED state	PROPORTIONAL OPERATING MODE: SP2 Output state	PROPORTIONAL OPERATING MODE: SP2 LED state
Deviation dV.hi dV.Lo bAnd			bAnd : on-off mode only	
Full Scale FS.hi FS.Lo				
Cool Strategy	Temperature above setpoint			

Output ON (Relay or SSd energized)

Output OFF (Relay or SSd de-energized)

LED ON

10.7 -AL- SP2 ALARM ANNUNCIATOR

When an SP2 alarm mode is selected in SP2.A the alarm annunciator - AL - is displayed, alternating with process temperature, during an alarm condition (or until reset if the latch alarm is selected).

The annunciator may be disabled. See Section 14. Function no.AL, select Option on

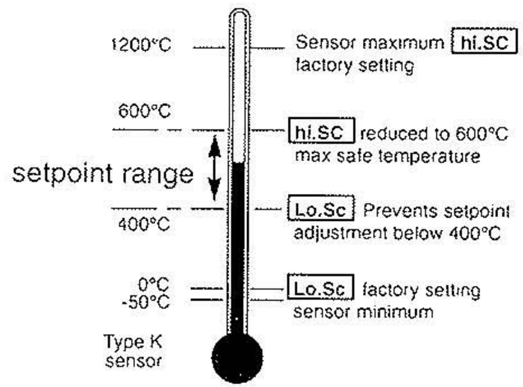
SECTION 11 RANGING AND SETPOINT LOCK

11.1 RANGING - IMPORTANT SAFETY NOTE:

The factory setting of full-scale [hi.SC] is the sensor maximum value. See Section 16.2.10. This should be reduced to a safe maximum for the plant.

1. [hi.SC] **full-scale and Lo.SC scale minimum**
    1. [hi.SC] limits the maximum setpoint adjustment, [lo.SC] limits the minimum. Both adjust over the full sensor range, including the negative.
    2. Factory settings:
       [hi.SC] = sensor maximum. [lo.SC] = [0°C/32°F]
       Reduce Lo.SC to set below [0°C/32°F]
    3. [hi.SC] may not be adjusted below the [lo.SC] setting, [lo.SC] not above [hi.SC]

2. **Example: Setpoint limited to 400° - 600°C**



11.2 [SP.LK] SETPOINT LOCK

This function in level 1 enables the machine setter to lock the setpoint, preventing unauthorized adjustment.

SECTION 12 TOOLS TO IMPROVE CONTROL ACCURACY

Use these tools to assist with machine development, commissioning and trouble shooting.

12.1 [SP1.P] READ SP1 OUTPUT PERCENTAGE POWER

Poor control may be due to incorrectly sized heaters.

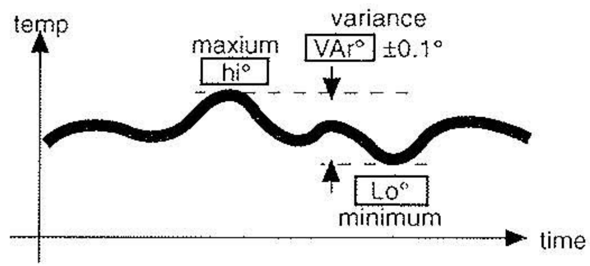
[SP1.P] constantly displays the output percentage power applied, which at normal setpoint should be within 10–80% (preferably 20–70%) to achieve accurate control.

12.2 [ChEK] CONTROL ACCURACY MONITOR

12.2.1 Establishing temperature control accuracy, to within 0.1°C/°F:

The monitor is started using [CheK] and the variance (deviation), maximum and minimum temperatures are displayed and constantly updated in [rEAd]

12.2.2 Control accuracy monitor - Read-outs:



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12.2.3 Using the [ChEK] Control accuracy monitor:

1. To start the monitor select [ChEK] [on]
2. During monitoring, either return to normal operation or remain in program mode.
3. To view monitor readings: Index to [rEAd]

Release ▼ or ▲

4. Press and hold ✱ to display variance (0.6°).

5. Press and hold ✱. Press ▲ once to display maximum (320.3°).

6. Press and hold ✱. Press ▲ once more to display minimum (319.7°).

7. [ChEK] [oFF] stops monitor, retaining readings. Next [ChEK] [on] resets readings.
8. On de-powering: [ChEK] resets to [oFF] and [rEAd] is zeroed.

SECTION 13 OEM PROGRAM SECURITY

13.1 ENTRY TO HIDDEN LEVEL 4

Access level 4 only at [VEr] in level 3.

Press and hold ▼ ▲ 10 sec.

Enter level 4 at [LoCK]

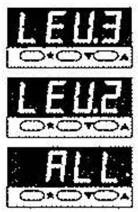
Release ▼ ▲ together.

Factory setting: [nonE]

13.2 PROGRAM SECURITY USING LOCK

Select from 3 [LoCK] options:

Press and hold ✱. Press ▲ to index.



Locks level 3 functions only - TECHNICAL FUNCTIONS.

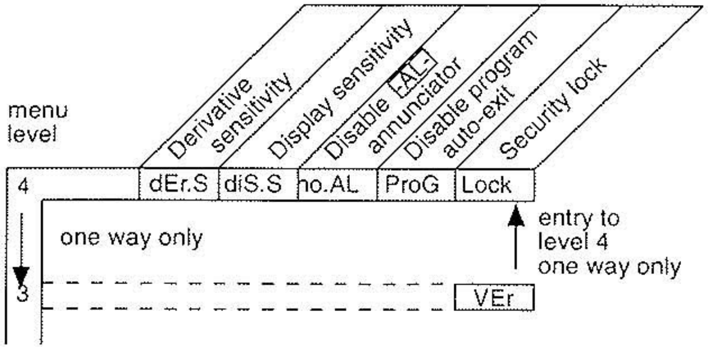
Locks levels 2 and 3 only - CONFIGURATION AND TECHNICAL FUNCTIONS.

Locks all functions ✱

13.3 NOTES:

- Locked functions and current options may be read.
- ✱ Unrestricted: [LEVL] [VEr] [dAtA] [SP.LK]

SECTION 14 TECHNICAL FUNCTIONS: SECURE LEVEL 4



14.1 **dEr.S** [0.1] - [1.0] x [dEr.t] [0.5]
Derivative sensitivity

14.2 **di.S.S** [dir] [1] - [32] [6]
Display sensitivity

[dir] = Direct display of input

[1] = Maximum [32] = Minimum sensitivity

14.3 **no.AL** [oFF] [on]
Disable SP2 Alarm annunciator [-AL-]

Select [on] to disable [-AL-]

14.4 **ProG** [Auto] [StAY]
Program mode auto-exit switch

Auto-exit returns display to normal if 60 sec key inactivity. Select [StAY] to disable.

14.5 **LoCK** [nonE] [LEV.3] [LEV.2] [ALL]
Program security lock, see Section 13.2.

SECTION 15 ERROR MESSAGES

1. **Sensor fault:**

Causes:
Thermocouple burnout
RTD/Pt100 short circuit
Negative over-range
Action: Check sensor/wiring.

2. **Non-volatile memory error:**

Action: De-power briefly.
Replace unit if it persists.

3. **Manual power error:**

Cause:
SP1 in ON/OFF in [CYC.t]

Action: Select proportional mode.

4. **Immediate fail on Autotune start:**

Cause:
1. Setpoint unset on new unit.
2. SP1 at ON/OFF in [CYC.t]

Action: Select proportional mode.

NOTE: Message latches. Press ▼ ▲ briefly to reset.

5. **Fail during Autotune tuning cycle:**

The thermal characteristics of the load exceed the Autotune algorithm limits. The failure point is the first display in [dAtA] with [0.0]

Action:

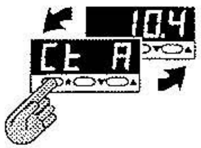
1. Change the conditions, e.g., raise setpoint.
2. Try [tunE] [At.SP]. See Section 7.2.3.
3. Check [SP1.P] percentage power. See Section 12.1.
4. If the error message persists, call OMEGA for advice.

6. **Reading Autotune tuning cycle results in [dAtA]**

Action:

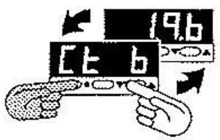
1. Index to [dAtA]

   Release ▼ or ▲



2. Press and hold ✱

   Display [Ct A] value (10.4), i.e., Cycle time 'A' = 10.4 sec



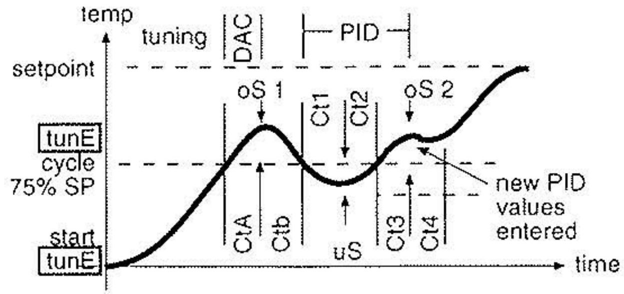
3. Keep ✱ pressed.

   Press ▲ once.

   Displays [Ct b] value (19.6), i.e., Cycle time 'b' = 19.6 sec

4. Repeat step 3 above to view:
   [Ct 1] [Ct 2] [Ct 3] [Ct 4], [oS 1] [uS] [oS 2]

7. **Autotune tuning data and limits:**



Autotune limits

Ct (Quarter cycle time): 1–1800 sec/30 min
oS (Overshoot) }
uS (Undershoot } max 255°C/490°F

SECTION 16 FUNCTIONS AND OPTIONS: LEVEL 1

SELECT AUTOTUNE

16.1.1 **tunE** [oFF] [on] [PArK] [At.SP]

Select Autotune, see Section 7, or PArK. [PArK] temporarily turns the output(s) off. To use, select [PArK] and exit program mode. [oFF] disables. Useful when commissioning fast loads or multizones.

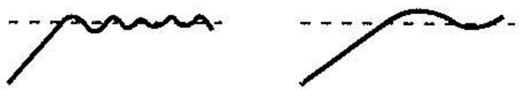
SP1 OPERATING PARAMETERS

16.1.2 **bAnd** [0.1] - [✱] °C/°F [10°C/18°F]

SP1 Proportional band/Gain or Hysteresis

*25% sensor maximum

Proportional control eliminates the cycling of on-off control. Heater power is reduced, by the time propor tioning action, across the proportional band.



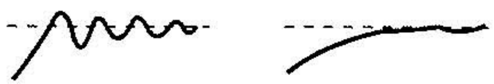
Too narrow (oscillates) Increase [bAnd]

Too wide (slow warm up and response) Decrease [bAnd]

16.1.3 Int.t [oFF] [0.1] - [60] minutes [5.0]

SP1 integral time/Reset

Auto-corrects proportional control offset error



Too short (overshoots and oscillates)

Too long (slow warm up and response)

16.1.4 dErt [oFF] [1] - [200] sec [25]

SP1 Derivative time/Rate

Suppresses overshoot and speeds response to distur bances.

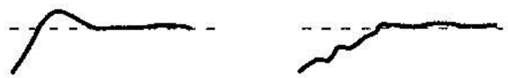
Too short (slow warm up and response, under corrects)

Too long (oscillates and over corrects)

16.1.5 dAC [0.5] - [5.0] x [bAnd] [1.5]

SP1 Derivative approach control...DAC

Tunes warm up characteristics, independent of normal operating conditions, by controlling when derivative action starts during warm up (smaller [dAC] value = nearer setpoint).



Too small (overshoots)

Too large (slow stepped warm up)

16.1.6 CYCt [A --] [on.oF] [0.1] - [81] secs [20]

SP1 Proportional cycle-time, see Section 9.

Determines the cycle rate of the out put device for proportional control. Select [on.oF] for ON/OFF mode.

Ideal

Too long (oscillates)

16.1.7 oFSt [0] - [*] °C/°F

SP1 Offset/Manual reset

* ±50% [bAnd] Applicable only in proportional mode with integral disabled [Int.t / oFF]

16.1.8 SPLk [oFF] [on]

Lock main setpoint, see Section 11.2.

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SP2 OPERATING PARAMETERS

16.1.9 **SEt.2** [0] - [*] – °C/°F

Adjust SP2 setpoint. See Section 10.

* Deviation alarms [DV.hi] [DV.Lo] [bAnd] 25% sensor maximum

* Full-scale alarms [FS.hi] [FS.Lo]: sensor range

16.1.10 **bnd.2** [0.1] - [*] °C/°F [2.0°C/3.6°F]

Select SP2 hysteresis or Proportional band/Gain

* 25% sensor maximum

16.1.11 **CYC.2** [on.oF] [0.1] - [81] sec

Select SP2 ON/OFF or Proportional cycle-time

Select [on.oF] for ON/OFF mode or the cycle rate of SP2 output device for proportional mode.

MANUAL CONTROL MODES

16.2.1 **SP1.P** [0] - [100]% "Read only"

Read SP1 output percentage power. See Section 12.

16.2.2 **hAnd** [oFF] [1] - [100]% (Not in ON/OFF)

SP1 manual percentage power control

For manual control should a sensor fail. First, record typical [SP1.P] values.

16.2.3 **PL.1** [100] - [0]% duty cycle

Set SP1 power limit percentage

Limits max SP1 heating power during warm up and in proportional band

16.2.4 **PL.2** [100] - [0]% duty cycle

Set SP2 percent power limit (cooling)

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SP2 OPERATING MODES: See Section 10.

16.2.5 **SP2.A** **Main SP2 operating mode**

[nonE] [dV.hi] [dV.Lo] [bAnd]

[FS.hi] [FS.Lo] [CooL]

16.2.6 **SP2.b** [nonE] [LtCh] [hoLd] [Lt.ho] [nLin]

Subsidiary SP2 mode: latch/sequence

Non-linear cool proportional band

INPUT SELECTION AND RANGING

16.2.7 **diSP** [1] [0.1]°

Select display resolution:

0.1° display of PV, SP, [OFSt] [Set.2] [hi.SC] [Lo.SC]

16.2.8 **hiSC** [sensor minimum] [sensor maximum] °C/°F

Set full scale. See Section11.1.

16.2.9 **LoSC** [sensor minimum] [sensor maximum] [0°C/32°F]

Set scale minimum. See Section 11.1.

16.2.10 **inPt** **Select input sensor** [nonE]

Option/ sensor type		sensor range			linearity ±°C
Thermocouples					
tc b	B	0 to 1800°C	32 to 3272 °F	Pt-30% Rh/Pt-6% Rh	2.0*
tc E	E	0 to 600°C	32 to 1112°F	Chromega®/Con	0.5
tc J	J	0 to 800°C	32 to 1472°F	Iron/Constantan	0.5
tc K	K	–50 to 1200°C	–58 to 2192°F	Chromega®/Alomega®	0.25*
tc L	L	0 to 800°C	32 to 1472°F	Fe/Konst	0.5
tc n	N	–50 to 1200°C	–58 to 2192°F	NiCroSil/NiSil	0.25*
tc r	R	0 to 1600°C	32 to 2912°F	Pt-13%Rh/Pt	2.0*
tc S	S	0 to 1600°C	32 to 2912°F	Pt-10%Rh/Pt	2.0*
tc t	T	–200/ 250°C	–273/ 482°F	Copper/Con	0.25*

Resistance thermometer

rtd	−200/ 400°C	−273/ 752°F	Pt100/RTD-2	0.25*

Linear process inputs (input mV range: −10 to 50mV)

	0–20mV		4–20mV setpoint limits	
Lin1	0 – 100		0 – 400	
Lin2		0 – 100	−25 – 400	
Lin3	0 – 1000		0 –3000	±0.5%
Lin4		0 – 1000	−250 – 3000	
Lin5	0 – 2000		0 – 3000	

Notes:

1. Linearity: 5–95% sensor range
2. *Linearity B:5° (70°–500°C)K/N: 1°>350°C
   exceptions: R/S:5°<300°C T:
   1°<−25°>150°C
   RTD/Pt100: 0.5°<−100°C
3. Optional PIM Process Interface Module provides additional input/output options

16.2.11 unit [nonE] [°C] [°F] [bAr] [PSi] [Ph] [rh]

Select °C/°F or process units.

Processor calculates in °C, when °F converts functions marked °C/°F (Process units calculate as °C).

SECTION 16 FUNCTIONS AND OPTIONS: LEVEL 3

OUTPUT CONFIGURATION

16.3.1 SP1.d [nonE] [rLY] [SSd]

Select SP1 output device. See Sections 5.3/6.2.4.

NOTE: "Read only" after initial configuration. [RSEt] [ALL] full reset to factory settings required to change [SP1.d] subsequently.

16.3.2 SP2.d [nonE] [SSd] [rLY] "Read only"

Read SP2 output device. See Sections 5.3/6.2.4.

Shows SP2 output device.

TECHNICAL FUNCTIONS

16.3.3 burn **Sensor burn-out/break protection**

CAUTION: Setting affects fail safe state.

	SP1	SP2
[uP.SC]	Upscale	Upscale
[dn.SC]	Downscale	Downscale
[1u.2d]	Upscale	Downscale
[1d.2u]	Downscale	Upscale

16.3.4 rEU.d **Select output modes: Direct/Reverse**

CAUTION: Setting affects fail safe state.

	SP1	SP2
[1r.2d]	Reverse	Direct
[1d.2d]	Direct	Direct
[1r.2r]	Reverse	Reverse
[1d.2r]	Direct	Reverse

Select **Reverse** on SP1 for heating and **Direct** for cool ing applications.

16.3.5 **rEUL** Selection of SP1/2 LED indicator modes

	SP1	SP2
1n.2n	Normal	Normal
1i.2n	Invert	Normal
1n.2i	Normal	Invert
1i.2i	Invert	Invert

16.3.6 **SPAn** [0.0] - [±25% sensor maximum]

Sensor span adjust

For recalibrating to a remote standard, e.g., external meter, data logger

16.3.7 **ZEro** [0.0] - [±25% sensor maximum]

Zero sensor error: See [SPAn]

16.3.8 **ChEY** [oFF] [on]

Select control accuracy monitor. See Section 12.2.

16.3.9 **rEAd** [VAr°] [hi°] [Lo°]

Read control accuracy monitor. See Section 12.2.

16.3.10 **dAtA** [Ct A] [Ct b] [Ct 1] [Ct 2] [Ct 3] [Ct 4] [os 1] [uS] [oS 2]

Read Autotune tuning cycle data. See Section 15.

16.3.11 **UEr** Software version number

16.3.12 **rSEt** [nonE] [ALL]

Resets all functions to factory settings

CAUTION: Note current configuration **before** using this function. See Section 18. Initial configuration and OEM settings must be re-entered.

INPUTS: See Section 16.2.10.

SECTION 17 SPECIFICATIONS

Thermocouple – 9 types

Standards: IPTS 68/DIN 43710
CJC rejection: 20:1 (0.05°/°C) typical
External resistance: 100Ω maximum

Resistance thermometer: RTD-2/Pt100 2 wire
Standards: DIN 43760 (100Ω 0°C/138.5Ω 100°C pt)
Bulb current: 0.2mA maximum

Linear process inputs: mV range: -10 to 50mV
see "PIM process Interface Module" for additional input/output options

Applicable to all inputs: SM = sensor maximum

Calibration accuracy: ±0.25% SM ±1°C
Sampling frequency: Input 10Hz, CJC 2 sec
Common mode rejection: Negligible effect up to 140dB, 240V, 50–60Hz
Series mode rejection: 60dB, 50–60Hz
Temperature coefficient: 150 ppm/°C SM
Reference conditions: 22°c ±2°c, rated voltage, after 15 minutes settling time

OUTPUT DEVICES (Standard): See Section 5.3.

- **SSd:** Solid state relay drive: To switch a remote SSR 5Vdc +0/-15% 10mA non-isolated
- **Miniature power relay:** From A/SPST contacts (AgCd0) 2A/250V~ resistive load

CONTROL CHARACTERISTICS: See Section 16.

SP1 PID Parameters: .1.1-.1.8
SP2 Parameters: .1.9-.1.11
SP2 Operating modes: .2.5-.2.6
Manual control modes: .2.1-.2.4

GENERAL

Supply voltage:	100-240V 50-60 Hz±10% 3VA 12V or 24V (AC/DC)±20% 3VA
Digital LED display:	4 digits, 10mm (0.4in), high brightness green Display range: -199 to 9999
Range:	Sensor limited: 2000°C/3500°F 0.1 hi-res mode – 199.9 to 999.9°
Displaying:	Process temperature (PV), Setpoint (SP), SP1/2 indicators (flashing), Error messages. Function/Option mnemonics
Keypad:	3 Elastomeric buttons

ENVIRONMENTAL — **Approvals**

Safety:	UL873, CSA 22.2/142-87, EN61010
Humidity:	Max. 80%
Altitude:	Up to 2000M
Installation:	Categories II and III
Pollution:	Degree II
Protection:	NEMA 4X, IP66
EMC Emission:	EN 50 081-1, VDE 0871/78 - Class A & B FCC Rules 15 subpart J Class A
EMC Immunity:	En50082-1 RF Field Test: < 200 MHz 1%FS > 200 MHZ 5% FS
Ambient:	0-50°C (32-130°F)
Mouldings:	Flame retardant polycarbonate
Weight:	100g (3.5ozs)

SECTION 18 CUSTOMER CONFIGURATION RECORD

SER No.						
Date						
LEVL						
1. bAnd						
int.t						
dEr.t						
dAC						
CYC.t						
SET.2						
bnd.2						
CYC.2						
2. SP1.P						
SP2.A						
SP2.b						
hi.SC						
Lo.SC						
inPt						
unit						
3. SP1.d						

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **37 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **three (3) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. P.O. number to cover the COST of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

M1638/1196

C Appendix C: Spare Parts List

02122 0020	Hydrogen shut-off valve (Alcon)
02122 0023	O-ring kit for Alcon valve
02122 0044	Hydrogen shut-off valve (Asco)
02122 0057	O-ring kit for Asco valve
4-5000-391	Utility gas regulator (H_2 or air)
59551 2097	Heater (flame cell and exhaust breather)
116901-GUB	Photometric tube
115000-0008	Power supply for electrometer board
115003-0001	Electrometer board
116910-KALREZ	O-ring kit for flame cell and detector
116906-0001	Ignitor with Kalrez O-ring
23608-0019	Heat filter
23608-0027	Optical filter

NOTICE

For price & delivery information please contact your local Emerson Sales office, or email gc.csc@emerson.com.

NOTICE

For spare parts for Model 500 or Model 700 Gas Chromatographs, please refer to the appropriate GC manual.

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