ROSEMOUNT Analytical

FLAME PHOTOMETRIC DETECTOR MODULE

FOR MODEL 500 & 700

GAS CHROMATOGRAPHS

HARDWARE REFERENCE MANUAL

ROSEMOUNT ANALYTICAL
ANALYSER DIVISION
TULLIBODY, SCOTLAND

Part Number : 09902 0066
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EMERSON Process Management

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PREFACE

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SECTION 1 : DESCRIPTION

1.1 The Purpose of This Manual

The Rosemount Analytical FPD Module Hardware Reference Manual (P/N 09902 0066) is intended as a user's guide to accompany the Rosemount Analytical FPD Module for use with Rosemount Analytical Model 500 & Model 700 Gas Chromatographs.

NOTE: For software operation instructions, see the Rosemount Analytical MON 2000 Software for Gas Chromatograph User Manual (P/N 3-9000-522).

For operating instructions for the Model 500 or Model 700 Gas Chromatograph, see the appropriate GC User Manual.

This manual provides the following information:

Section 1 Description
A general description of the FPD Module and its components.
A brief description of the GC System's software, user interfaces, and capabilities.
Introduction to GC theory of operation and terminology.

Section 2 Equipment Description
Guidelines for sampling system and gas connections.
Descriptions of Analyzer subsystems and components.
Descriptions of GC Controller subsystems and components.

Section 3 Operation
Instructions for operating the GC System by means of its built-in keypad and liquid crystal display (LCD), if provided.

Section 4 Maintenance
Instructions for regular maintenance and care of the GC System hardware.
Instructions for troubleshooting, repair, and service of the GC System hardware.

Section 5 Fault Finding
List of boards, valves, and other components suggested as spare parts.

Appendices

Appendices with additional, helpful reference materials and drawings.

1.2 Introduction

The Rosemount Analytical FPD Module is a Flame Photometric Detector that is factory engineered to be used in conjunction with either a Model 500 or a Model 700 Gas Chromatograph. The FPD Module can be used as a single detector, to measure low levels of sulphur compounds in natural gas, or as a second detector in conjunction with a Thermal Conductivity Detector (TCD) mounted in the GC where the application requires full analysis of the natural gas plus sulphur compounds. The FPD Module typically consists of three major components, flame cell, the photomultiplier tube, and the electrometer circuit board :

The Flame Cell : Located in the lower enclosure, the flame cell has connections for fuel gas (Hydrogen), HC 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 : Located in the lower enclosure, the photomultiplier tube is the sensor that measures the light that is emitted from the flame cell during operation using an optical filter to allow only sulphur wavelength light to be seen by the photomultiplier detector. It has one high voltage lead and one signal lead that takes the signal from the detector to the electrometer. The leads are co-axial type cables.

The Electrometer Board : 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 (2350A controller on Model 500). It also provides the ignition circuit, controls the relight function, generates the flame out alarm, and operates the Hydrogen shut off valve.

1.3 Theory of Operation

NOTE: See also section 1.4, the "Glossary" section of this manual, for definitions of some of the terminology used in the following explanations.

1.3.1 The Analyser Detector

The detection system in a Rosemount Analytical FPD Module is a Flame Photometric Detector. This uses the reactions of Sulphur components in a Hydrogen/Air flame as a source of 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, that is, a photochemical process called chemiluminescence.

FIGURE 1.1 : FPD DETECTOR

The analysis begins when a fixed volume of sample is injected into the column by operation of the sample valve. The sample is moved through the column by the continuous flow of carrier gas. As successive components elute from the GC column system, they are burned in the flame cell. An optical filter is fitted between the flame cell and the photomultiplier tube (PMT). This allows only the wavelength of the emission band for Sulphurs, 394 nm, to pass through to the PMT.

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 5 seconds and opens the Hydrogen shut off valve. It then repeats this process for a maximum of ten times until the flame is lit. If it does not succeed, then the Hydrogen is shut off, an alarm is set on the GC controller and the unit awaits attention from the operator.

Figure 1-3 illustrates the change in detector electrical output during elution of a component.

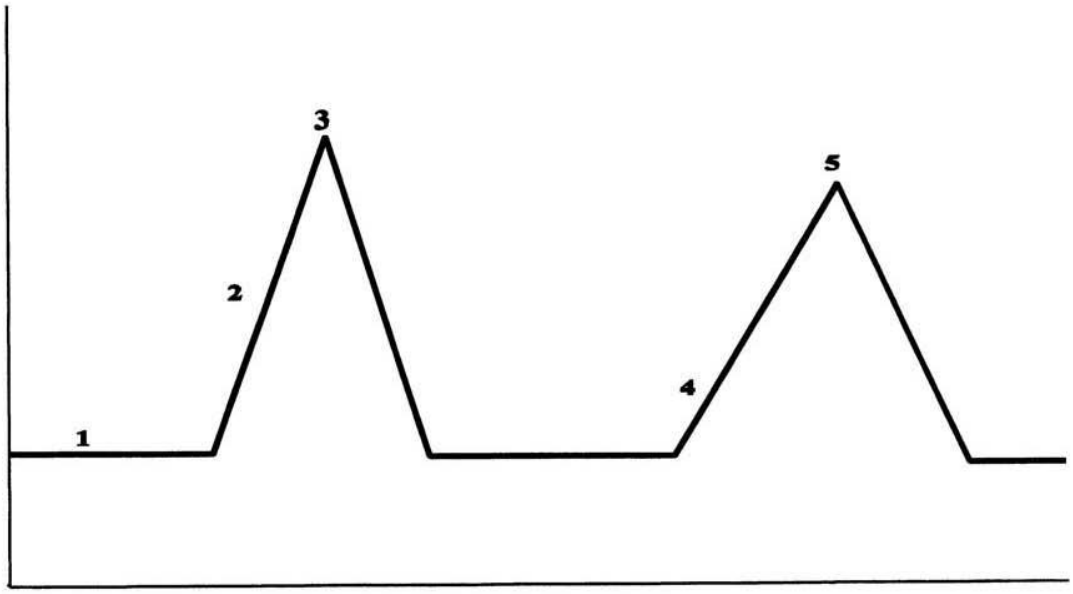

FIGURE 1.2 : ELUTION OF COMPONENTS

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 sent from PMT to the Electrometer to be amplified. The Electrometer also provides the PMT with the high voltage it requires to operate and the auto relight circuits.

The signal is then sent to the preamplifier board for further amplification. In addition the preamplifier converts the voltage signal to a 4 to 20 milliamp (mA) current loop for transmission to the GC controller. The signal is proportional to the concentration of a 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 Controller for computation, recording on a printer, or viewing on a PC monitor or LCD.

In the quiescent condition (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 approximately 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.

1.4 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 colour as it is processed on a PC VGA display. Tick marks recorded on the chromatogram by the GC Controller indicate where timed events take place.

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:

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

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.

SECTION 2 : DESCRIPTION OF EQUIPMENT

2.1 General Information

There are three different versions of the FPD module : Model 500 FPD ; Model 700 FPD ; Model 700 Front Entry FPD. All versions are covered by the same ATEX certificate Sira06ATEX1174 (see Appendix A). The differences between the versions will be detailed in later sections of this manual.

FIG 2.1 : 500 FPD

FIG 2.2 : 700 FPD

FIG 2.3 : 700 FRONT ENTRY

2.2 Gas connections.

For all FPD analysers used to measure low range sulphur components, consideration should be given to the use of sulphur inert or equivalent tubing for all calibration gas & process gas connections. All internal process pipework, columns etc are silcosteel by design. If 316 or other stainless steel piping is used, the sulphur components will adhere to the internal surface of the pipe, and will continue to do so until such times are the entire internal surface is coated or “conditioned”. This will result in lower than expected levels of sulphur components reaching the detector for measurement. If the sulphur concentration in the line decreases, sulphur components will detach from the wall of the tubing, resulting in an artificially high reading at the detector. Conditioning may take one week or longer, depending on the levels of sulphur components and the length of the pipe runs.

2.3 Environmental Considerations

All Rosemount Analytical FPD detectors are sensitive to changes in temperature and pressure. It is recommended that FPD analysers are located in shelters that have stable temperature & pressure. The use of positive pressurisation for shelters is not recommended.

2.4 Utilities

Rosemount Analytical FPD analysers require the following utility gases :

Hydrogen 99.995% purity

Hydrocarbon Free Air

Nitrogen 99.995% purity (carrier gas)

Helium 99.995% purity (optional 2nd carrier – application specific)

Calibration gas – application specific

All utility & process gas connections are Swagelok 1/8" double ferrule compression fittings. Metric conversion kits can be supplied on request.

Supply Voltage : **Either** 230 Vac **or** 110Vac.

TYPICAL PRESSURE & FLOW RATE INFORMATION

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

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

A water container is necessary for use with the FPD Module to collect the condensed water from the FPD vent. It is not recommended to pipe the vent away unless a continuous downward slope on the pipe and no back pressure or obstruction by water can be guaranteed.

2.5 Model 500 FPD

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

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

FIG 2.4 : ELECTROMETER ASSEMBLY

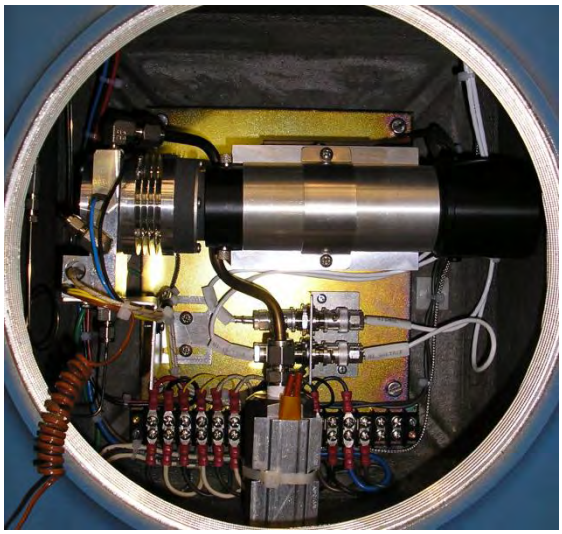

FIG 2.5 : FLAME CELL & FP TUBE

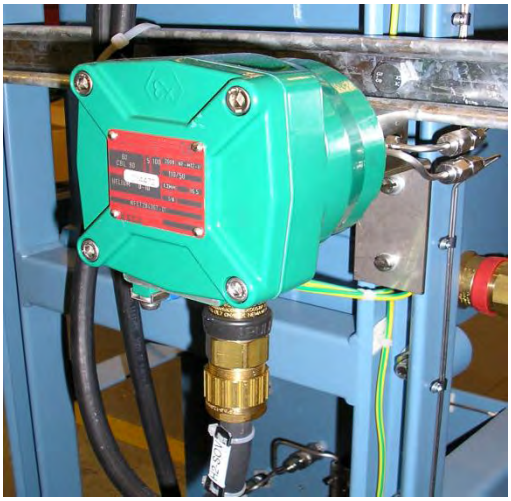

FIG 2.6 : H2 SHUT OFF VALVE

FIG 2.7 : TRANSFORMER

The FPD module needs to located as close as possible to a Model 500 GC to minimise the length of sample tubing between the two parts, and therefore to keep the cycle time as short as possible.

FIG 2.8 : Model 500 FPD

The tubing required to operate the FPD flame cell is 1/16” OD 0.010” 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.

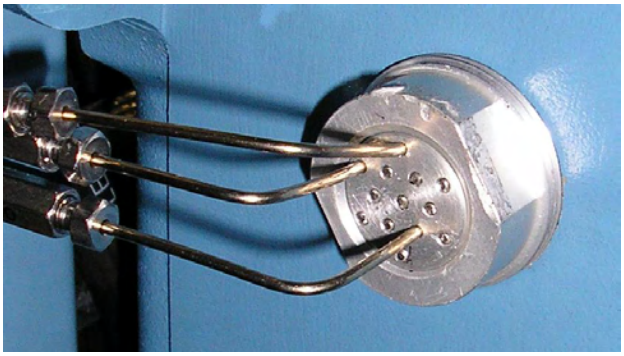

FIG 2.9 : TUBING GLAND

2.6 Model 700 FPD

The Model 700 FPD module consists of four Exd GUB enclosures mounted on a frame, plus an Exd solenoid valve which acts as a Hydrogen shut-off valve. The Model 700 FPD requires an additional enclosure to house temperature control equipment that is available internally on a Model 500 GC, but not on a Model 700 GC. These enclosures contain the following :

1. Electrometer assembly in GUB 5 enclosure. (see FIG 2.4)
2. Flame cell and photometric detector tube in GUB 5 enclosure. (see FIG 2.5)
3. PID Temperature controller & relay.
4. Transformer (either 230/110Vac or 110/110Vac) in GUB 4 enclosure. (see FIG 2.7)
5. Hydrogen shut-off valve. (see FIG 2.6)

FIG 2.10 : PID TEMPERATURE CONTROLLER & RELAY

The FPD module needs to be located as close as possible to a Model 700 GC to minimise the length of sample tubing between the two parts, and therefore to keep the cycle time as short as possible. (see FIG 2.2)

The tubing required to operate the FPD flame cell is 1/16” OD 0.010” 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.

2.7 Model 700 FPD Front Entry

The Model 700 FPD Front Entry is comprised of the same components as the standard 700 FPD, but an additional frame has been 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, as no rear access is required for installation or maintenance. (see FIG 2.3)

2.8 Venting.

All Rosemount Analytical 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 vapour as a result of burning Hydrogen as fuel. This vapour condenses in the exhaust tubing outside the GUB enclosure, and can be seen as drips of water.

The FPD exhaust must be allowed to vent to atmosphere. It must not be subjected to any back pressure as this will have a detrimental effect on the detector, and may cause the flame to extinguish.

For information on Model 500 GC & 700 GC venting, please consult the appropriate hardware manual.

SECTION 3.0 : OPERATION

The Rosemount Analytical FPD module is operated as a separate detector. It is controlled by, and reports to the GC controller. The flow rates for the utility gases and the carrier gas are factory set, and are specific to each individual detector. **These should only be adjusted by fully trained and authorised personnel.**

The FPD module is identified as detector # 1 on MON software. When used in conjunction with a TCD detector, the FPD is detector # 1 and the TCD is detector # 2.

For GC controller and MON software operation, please consult the appropriate manual.

For FPD operation, please refer to Appendix C in this manual.

SECTION 4 : MAINTENANCE

4.1 The Rosemount Analytical FPD module is a complex piece of equipment, and needs to be regularly maintained, preferably as part of a planned maintenance regime.

There are only two important operations that need to be conducted routinely :

1. Replace the Flame Cell and Photometric Tube O-rings (18 – 24 months).
2. Lubricate the stem of the Hydrogen shut-off valve (12 months).

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

Maintenance operations should only be carried out by trained & authorised personnel.

Failure to maintain the FPD module correctly may cause loss of functionality, and can result in catastrophic failure.

See APPENDIX B for the correct drawings, and APPENDIX D for the recommended spare parts list.

SECTION 5.0 : FAULT FINDING

Fault finding on Rosemount Analytical FPD modules should only be carried out by competent trained personnel.

This section of the manual is not intended to be a definitive list of every fault that can occur on a FPD module. It only details the most common faults.

Fault Symptoms	Possible Cure
When monitoring the baseline in MON, 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. -600VDC 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.
If upsets are being seen but there are no peaks when gas is injected.	Vary the H2/Air ratio Check the 12v 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 & 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 will need 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.

Air & H2 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. Use the OVERRIDE function on the electrometer when ignitor signal can be seen on a chromatogram and observe to see if it stays lit. If the flame stays on, the problem is with the temperature sensor circuit. 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. Ensure the ignitor is connected. 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 whilst watching the CGM to see if that cures the fault.
Flame cell temperature cannot be controlled.	Check the flame cell thermistor. The resistance is approx 100KΩ 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.

Flame cell temperature is erratic.	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 N2 flow into union at flame-cell. This should be no less than 15cc/min.
Noisy baseline and/or very big dips on the baseline	Check the air supply, should be no lower that 500psi in the cylinder

APPENDIX A

CERTIFICATION

1. ATEX Certificate Sira06ATEX1174
2. EC Declaration of Conformity

Above certificates were correct at the time this manual was issued. Please contact factory for updates.

1 **EC TYPE-EXAMINATION CERTIFICATE**

2 Equipment intended for use in Potentially Explosive Atmospheres Directive 94/9/EC

3 Certificate Number: **Sira 06ATEX1174** Issue: **4**

4 Equipment: **FPD Model**

5 Applicant: **Emerson Process Management Limited**

6 Address: Unit 5 Block 2 Dumyat Business Park
Tullibody
Clackmannanshire FK10 2PB
UK

7 This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

8 Sira Certification Service, notified body number 0518 in accordance with Article 9 of Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in the confidential reports listed in Section 14.2.

9 Compliance with the Essential Health and Safety Requirements, with the exception of those listed in the schedule to this certificate, has been assured by compliance with the following documents:

EN 60079-0:2004 EN 60079-1:2004

10 If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

11 This EC type-examination certificate relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment.

12 The marking of the equipment shall include the following:

II 2 G
Ex d IIC T4 Ta = 60°C

Project Number 51A20364
C. Index 14

C Ellaby
Certification Officer

Sira Certification Service
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13 **DESCRIPTION OF EQUIPMENT**

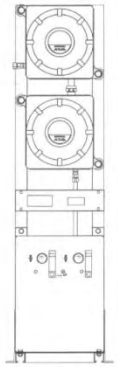

Figure 1: Drawing of an FPD Module

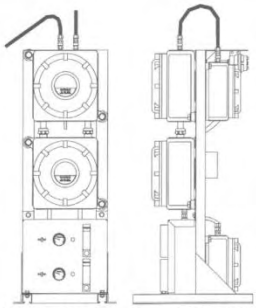

Figure 2: Drawing of an FPD Module with Temperature Controller Enclosure

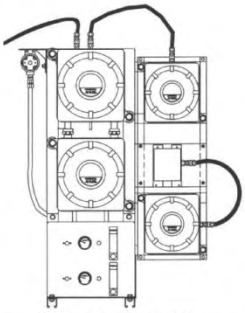

Figure 3: Drawing of the alternative front entry layout

The FPD Module, as shown in Figure 1, is intended to detect the presence of flammable gases when used with suitable analyser controllers. It comprises the following main parts:

Detector Module: The Detector Module (DM) comprises a Flame Photometric Detector (FPD) mounted within a component approved, GUB5 Enclosure manufactured by JCE (Europe) Ltd, as detailed in Certificate No. ISSeP 03ATEX004U. Process pipes and the FPD fuel gas pipe enter and exit the enclosure via Gas Inlet/Outlet Glands (GI/OGs). The fuel gas for the FPD vents from the enclosure via a component approved sintered metal flame arrestor manufactured by M & C Products as detailed in Certificate No. KEMA 03ATEX2114U.

Detector Control Module: The Detector Control Module (DCM) comprises a GUB5 Enclosure as detailed in Certificate No. ISSeP 03ATEX004U containing the FPDs associated electronics circuitry. The DCM is connected to the DM via an M20 Union Connector.

Transformer Assembly: The Transformer Assembly (TA) comprises a GUB4 Enclosure, as detailed in Certificate No. ISSeP 03ATEX004U, and contain a mains supply transformer for the DM & DCM.

Union Connector: The Union Connector (UC) has a male and female section. The male section comprises a hollow cylindrical brass body with an M20 male threaded portion, which is intended to screw into an entry point on its associated enclosure, at one end and a male spigot portion at the other. The female section comprises a hollow cylindrical brass body with an M20 male threaded portion, which is intended to screw into an entry point of its associated enclosure, at one end and a female threaded portion at the other. The male section spigot interfaces with the female section and is secured by a hexagonal-profile locking nut that tightens onto the female thread. The internal bore is filled with a setting compound, which is keyed by way of two circlips, within the male section.

Gas Inlet/Outlet Glands: The Gas Inlet/Outlet Glands (GI/OGs) comprise a cylindrical stainless steel body with an M16 male thread along its length with the exception of a hexagonal head at one end. The body has a central bore to allow the passage of the process pipes and the hexagonal head contains an M3 threaded hole for the fitting of a hexagon socket head grub screw.

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Email: info@siracertification.com
Web: www.siracertification.com

Variation 1 - This variation introduced the following changes:

i. The introduction of a Temperature Controller Enclosure and a shorter frame to facilitate use with a Model 700 gas chromatograph, see Figure 2.

Variation 2 - This variation introduced the following changes:

i. The address of the applicant was changed from Unit 3B, Dumyat Business Park, Tullibody, Clackmannanshire, FK10 2PB.
ii. The label was amended to recognise that the number of the notified body involved with the quality phase has been changed.

Variation 3 - This variation introduced the following changes:

i. The removal of explicit reference to Hawke Type ICG Universal Cable Glands was recognised.
ii. The option to replace the Alcon Solenoid Coil with an Asco Solenoid Valve was sanctioned.
iii. The optional alternative front entry layout of the enclosures was introduced, as detailed in Figure 3.

Variation 4 - This variation introduced the following changes:

i. The positioning of the GUB5 Enclosures was reversed to put the FPD Exhaust at the bottom of the analyser.
ii. The Gas Inlet/Outlet Glands was replaced by the Tube Adaptors that are detailed in certificate no. Sira 04ATEX1055X Issue 7.
iii. Drawing notes were changed to update the references to the certifying standards.

14 DESCRIPTIVE DOCUMENTS

14.1 Drawings

Refer to Certificate Annexe.

14.2 Associated Sira Reports and Certificate History

Issue	Date	Report no.	Comment
0	31 October 2006	R51A15279A	The release of the prime certificate.
1	18 September 2007	R51A16935A	This Issue covers the following changes: • All previously issued certification was rationalised into a single certificate, Issue 1, Issue 0 referenced above is only intended to reflect the history of the previous certification and has not been issued as a document in this format. • The introduction of Variation 1.
2	03 July 2008	R51A18574A	The introduction of Variation 2.
3	5 February 2009	R51A19581A	The introduction of Variation 3.
4	26 June 2009	R51A20364A	The introduction of Variation 4.

Sira Certification Service
Rake Lane, Eccleston, Chester, CH4 9JN, England

Tel: +44 (0) 1244 670900
Fax: +44 (0) 1244 681330
Email: info@siracertification.com
Web: www.siracertification.com

SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE **Sira 06ATEX1174**
Issue 4

15 **SPECIAL CONDITIONS FOR SAFE USE** (denoted by X after the certificate number)

None

16 **ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF ANNEX II** (EHSRs)

The relevant EHSRs that are not addressed by the standards listed in this certificate have been identified and individually assessed in the reports listed in Section 14.2.

17 **CONDITIONS OF CERTIFICATION**

17.1 The use of this certificate is subject to the Regulations Applicable to Holders of Sira Certificates.

17.2 Holders of EC type-examination certificates are required to comply with the production control requirements defined in Article 8 of directive 94/9/EC.

17.3 The Modules covered by this certificate incorporate previously certified devices, it is therefore the responsibility of the manufacturer to continually monitor the status of the certification associated with these devices, and the manufacturer shall inform Sira of any modifications of the devices that may impinge upon the explosion safety design of the Modules.

Sira Certification Service
Rake Lane, Eccleston, Chester, CH4 9JN, England

Tel: +44 (0) 1244 670900
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Web: www.siracertification.com

Certificate Annexe

Certificate Number: **Sira 06ATEX1174**

Equipment: **FPD Model**

Applicant: **Emerson Process Management**

Issue 0

Drawing No.	Sheet	Rev.	Date (Sira stamp)	Description
DUK7233/003/1	1 of 1	1	07 Jul 06	FPD Module Top Housing Assembly
DUK7233/004/1	1 of 1	1	07 Jul 06	FPD Module Bottom Housing Assembly
DUK7233/010/1	1 of 1	1	07 Jul 06	M20 Union Connection
DUK7233/011/1	1 of 1	1	07 Jul 06	Gas Inlet/Outlet Gland
DUK7233/013/1	1 of 1	0	07 Jul 06	FPD Module General Arrangement
DUK7233/015/3	1 of 1	2	31 Oct 06	FPD Module ATEX Certification Label

Issue 1

Drawing No.	Sheet	Rev.	Date (Sira stamp)	Description
DUK7204/100/1	1 of 1	0	16 Aug 07	Model 700 FPD Module G/A
DUK7233/101/1	1 of 1	0	16 Aug 07	Model 700 FPD Module Temperature Controller Enclosure

Issue 2

Drawing No	Sheet	Rev.	Date	Description
DUK7233/013/3	1 of 1	3	27 Mar 08	FPD Module ATEX Certification Label

Issue 3

Drawing No.	Sheet	Rev.	Date (Sira stamp)	Description
DUK7204/100/1	1 of 1	1	30 Jan 09	Model 700 FPD Module G/A
DUK7204/156/1	1 of 1	0	30 Jan 09	G/A FPD Module Front Access
DUK7233/013/1	1 of 1	1	30 Jan 09	G/A Model 500 FPD Module

Issue 4

Drawing	Sheets	Rev.	Date (Sira stamp)	Title
DUK7204/100/1	1 of 1	2	10 Jun 09	GA 700 FPD Module
DUK7204/156/1	1 of 1	1	10 Jun 09	GA 700 FPD Module Front Entry
DUK7233/013/1	1 of 1	2	10 Jun 09	GA 500 FPD Module
DUK7233/060/1	1 of 1	0	10 Jun 09	FPD Module Bottom Housing Assembly
DUK7233/061/1	1 of 1	0	10 Jun 09	FPD Module Top Housing Assembly
BE20878	1 of 1	G	10 Jun 09	Fitting Tube Taper Enclosures Model 700 GC
BE20879	1 of 1	C	10 Jun 09	Tube Fitting Nut Enclosures Model 700 GC
BE20908	1 of 1	C	10 Jun 09	Fitting Tube Adaptor Enclosures Model 700 GC

Sira Certification Service
Rake Lane, Eccleston, Chester, CH4 9JN, England
Tel: +44 (0) 1244 670900
Fax: +44 (0) 1244 681330
Email: info@siracertification.com
Web: www.siracertification.com

Emerson Process Management Ltd.
Gas Chromatograph Division
Unit 5 Block 2
Dumyat Business Park
Tullibody
Scotland
FKl0 2PB
Tel: +44 1259 727224
Fax: +44 1786 433686
www.emersonprocess.com

EC DECLARATION OF CONFORMITY

Name of Manufacturer : **Emerson Process Management Ltd**

Address of Manufacturer : **Unit 5 Block 2**
Dumyat Business Park
Tullibody
Scotland
FK10 2PB

We declare under our sole responsibility that the undernoted equipment conforms with the protection requirements of the following Council directives :

2004/108/EC (The EMC Directive)
94/9/EC (The ATEX Directive)

on the approximation of the laws of the Member states relating to electromagnetic compatibility and equipment and protective systems intended for use in potentially explosive atmospheres .

Equipment : FPD Module

Product Marking :

II 2 G
Ex d IIC T4 Ta = 60°C

Applicable Standards :

2004/108/EC (The EMC Directive)

EN 61326-1: 2006
(Electrical Equipment for Measurement Control and Laboratory Use : EMC requirements)

EN 55011 : 1998 + Amendments A1 1999 & A2 2002
Industrial, scientific and medical (ISM) radio frequency equipment – Electromagnetic disturbance characteristics – Limits and method of measurement.

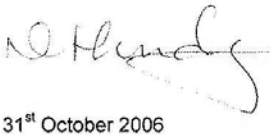
Emerson Process Management Ltd.
Gas Chromatograph Division
Unit 5 Block 2
Dumyat Business Park
Tullibody
Scotland
FK!0 2PB
Tel: +44 1259 727224
Fax: +44 1786 433686
www.emersonprocess.com

94/9/EC (The ATEX Directive)

Notified Body (QAN)	:	Sira Certification Rake Lane, Eccleston Chester, CH4 9JN (Notified Body Number 0518)
EC-type Examination Certificate :		Sira06ATEX1174

BSEN 60079-0 : 2004
Electrical apparatus for potentially explosive atmospheres (General Requirements)

BSEN 60079-1 : 2004
Electrical apparatus for potentially explosive atmospheres (Flameproof enclosures "d")

Name of authorised responsible person	:	Neil Hendry
Position	:	Sustaining & Certification Engineer
Signature	:	
Date & Place of first issue	:	31st October 2006 Tullibody

APPENDIX B

DRAWINGS

Model 500 FPD Drawings

DUK 7233/013/1	GENERAL ARRANGEMENT : MODEL 500 FPD MODULE
DUK 7233/002/1	GENERAL ARRANGEMENT : MODEL 500 FPD ANALYSER
DUK 7233/039/1	GENERAL ARRANGEMENT : MODEL 500 FPD DUAL ANALYSER
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 DIARAM : 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 DIARGAM : 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
DUK 7233/031/1	FLOW DIAGRAM : 500 FPD : TBM/THT
DUK 7233/032/1	FLOW DIAGRAM : 500 FPD : SULPHUR
DUK 7233/035/1	FLOW DIAGRAM : 500 FPD : C6+/SULPHUR
DUK 7233/045/1	FLOW DIAGRAM : 500 FPD : C6+/SULPHUR
DUK 7233/046/1	FLOW DIAGRAM : 500 FPD : DUAL RANGE DMS
DUK 7233/047/1	FLOW DIAGRAM : 500 FPD : SULPHUR – 6 x 6 PORT – 20 MINUTE CYCLE
DUK 7233/049/1	FLOW DIAGRAM : 500 FPD : DUAL RANGE DMS
DUK 7233/050/1	FLOW DIAGRAM : 500 FPD : C6+/SULPHUR
DUK 7233/051/1	FLOW DIAGRAM : 500 FPD : C6+/MERCAPTANS
DUK 7233/052/1	FLOW DIAGRAM : 500 FPD : C6+/SULPHUR
DUK 7233/053/1	FLOW DIAGRAM : 500 FPD : C6+/SULPHUR – HIGH C3 & C4 – VALCO 6 PORT INJECTION VALVE
DUK 7233/055/1	FLOW DIAGRAM : 500 FPD : SULPHUR – 6 x 6 PORT - 30 MINUTE CYCLE
DUK 7233/057/1	FLOW DIAGRAM : 500 FPD : TOTAL SULPHUR – 5 x 6 PORT
DUK 7233/063/1	FLOW DIAGRAM : 500 FPD : MM/H2S/COS – 5 x 6 PORT

Model 700 FPD Drawings

DUK 7204/074/1	GENERAL ARRANGEMENT : 700 FPD ANALYSER
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 ANALYSER
DUK 7204/103/1	POWER WIRING DIAGRAM : 700 FPD ANALYSER
DUK 7204/129/1	FLOW DIAGRAM : DET 1 BFM, DCV. DET 2 BFV. He/N2 CARRIERS
DUK 7204/134/1	FLOW DIAGRAM : DET 1 BFM, DCV. EXTERNAL STR SWITCH
DUK 7204/136/1	FLOW DIAGRAM : DET 1 BFM, SWV
DUK 7204/137/1	FLOW DIAGRAM : DET 1 BFM, DCV. INTERNAL STR SWITCH
DUK 7204/138/1	FLOW DIAGRAM : DET 1 BFM. DET 2 BFV, HCV
DUK 7204/159/1	FLOW DIAGRAM : DET 1 BFM, SWV, BFV
DUK 7204/170/1	FLOW DIAGRAM : DET 1 BFM, DCV. DET 2 BFM

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 2.5mm^2 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.

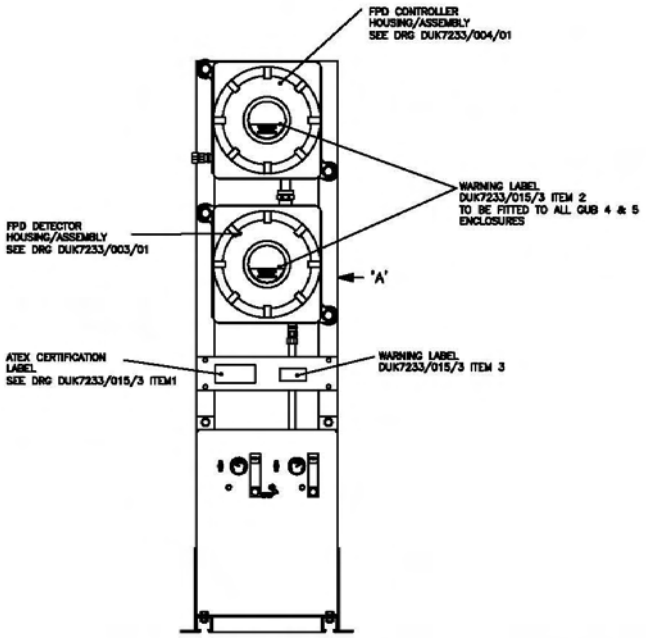
10. ALL UNUSED CABLE ENTRIES MUST BE SEALED WITH A Exd SEALING PLUG CERTIFIED TO BS EN 60079-0 & 60079-1
11. THE POWER SUPPLY TO THE UNIT MUST BE FROM A MCB OR FUSE 10A MAX. THE SUPPLY MUST BE PROTECTED BY A MANUAL RESET EARTH LEAKAGE DEVICE.

EMERSON. PROCESS MANAGEMENT

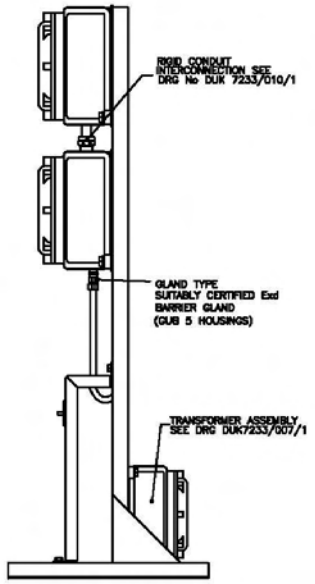
CERTIFICATE SCHEDULE DRG
SIRA CERTIFIED PRODUCT

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	



FRONT VIEW



VIEW ON ARROW 'A'

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
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1	20/01/09	NH	ECN 2503/09	GM	NH
0	07/05/06	CTS	RELEASED	GM	DG

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: SEE ORDER
FINISH: N/A

GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
XXX ±.005
XXXX ±.0005
ANGULAR ±0° 30'
FINISH 63 RA MAX

BREAK ALL SHARP CORNERS TO .005-.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

ISSUE 0

DRAWING NUMBER DUK7233/002/1 SH 1 OF 1

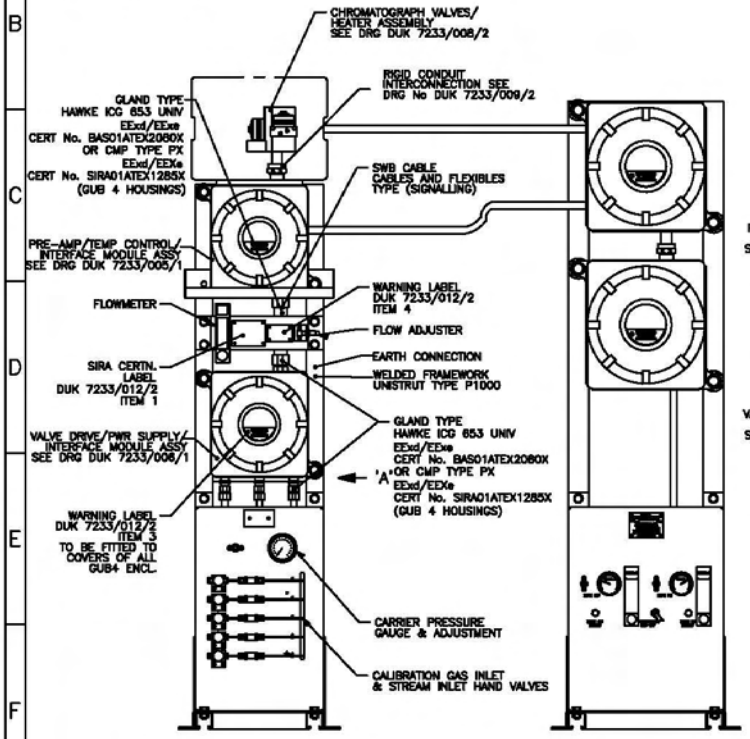
NOTES:
1. ALL METAL USED IN CONSTRUCTION TO HAVE A MAGNESIUM CONTENT OF LESS THAN 6%.
2. MAX AMBIENT TEMPERATURE 55°C.
3. MAX AMBIENT TEMPERATURE INSIDE WEATHERPROOF HOUSING 60°C.
4. EQUIPMENT MUST BE INSTALLED IN COMPLIANCE WITH EN60079-14
5. ALL FLAMEPROOF ENCLOSURES ARE INSTALLED IN COMPLIANCE WITH 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 2.5mm^2 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 50014 & 50018
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.

DANIEL

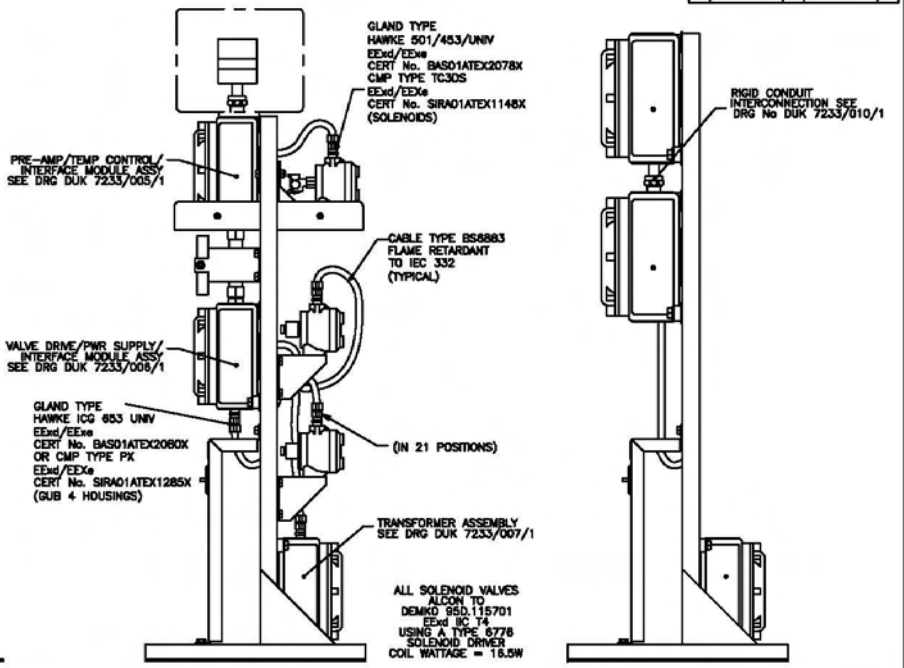
CERTIFICATE SCHEDULE DRG
SIRA CERTIFIED PRODUCT

NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO ISSEP

REV	CERT ENG NAME	CERT ENG SIG	QUALITY NAME	QUALITY SIG



FRONT VIEW
(WITH TOP ENCLOSURE REMOVED)



VIEW ON ARROW 'A'

ISS	DATE	CHANGE	CHKD	APPD
0	1/08/05	FIRST ISSUE		

ORIG SCALE 1:5 A1
DIMENSIONS IN –
REF –

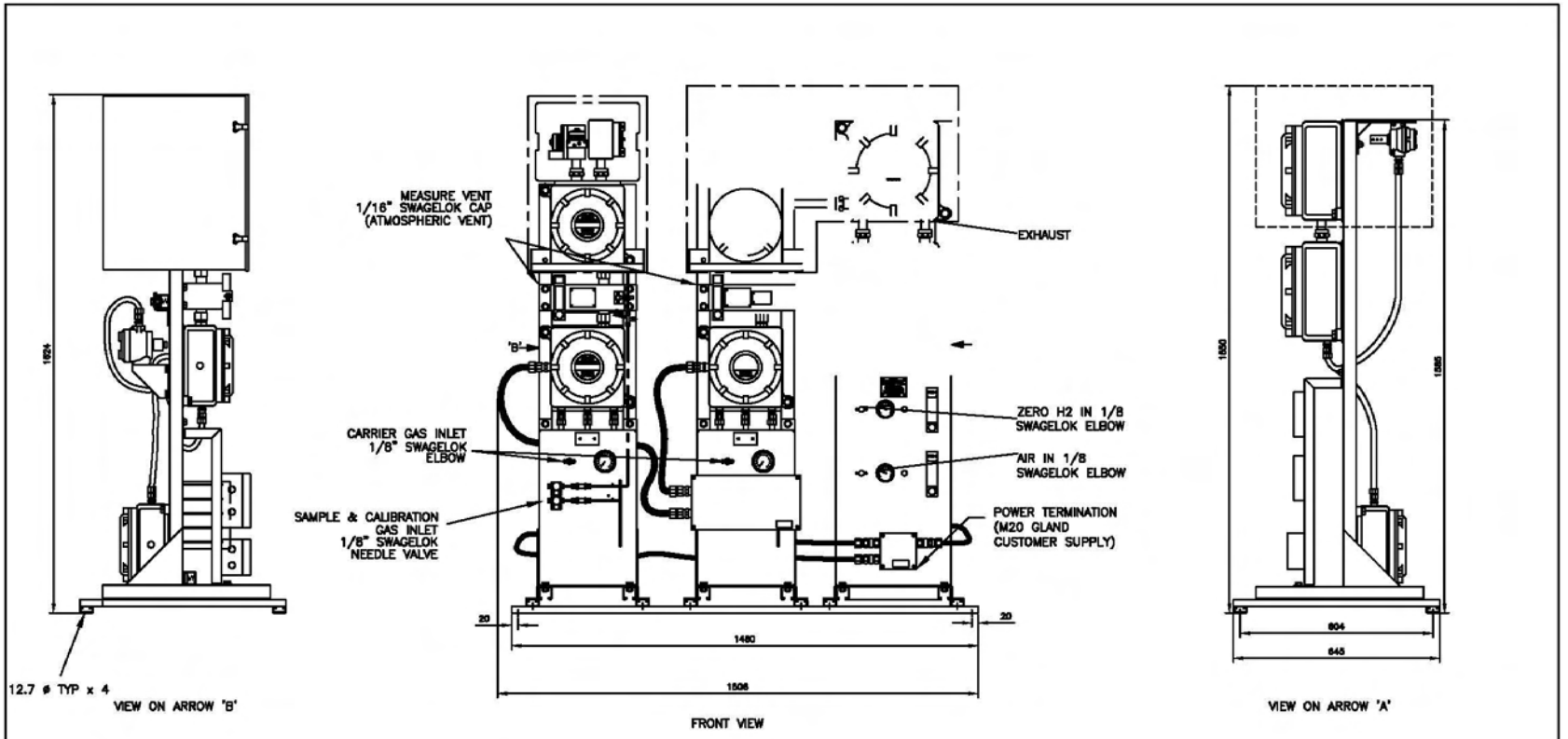
DANIEL

ANALYSER MODEL 500 FPD
GENERAL ARRANGEMENT

DRAWING NUMBER DUK7233/002/1 SH 1 OF 1

DRAWN CTS

ISSUE 0



SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: SIZE ORDER	2	28/03/07	CTS	ECN 2505/08	CTS	NH
FINISH:	1	28/03/07	CTS	ECN 2551/07	CTS	DG
	0	23/11/05	CTS	RELEASED	CTS	DG
	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

ORIG SCALE - A1

DIMENSIONS IN INCHES

REF -

BREAK ALL SHARP CORNERS TO .003-.005 RADIUS AND REMOVE ALL BURRS

EMERSON PROCESS MANAGEMENT

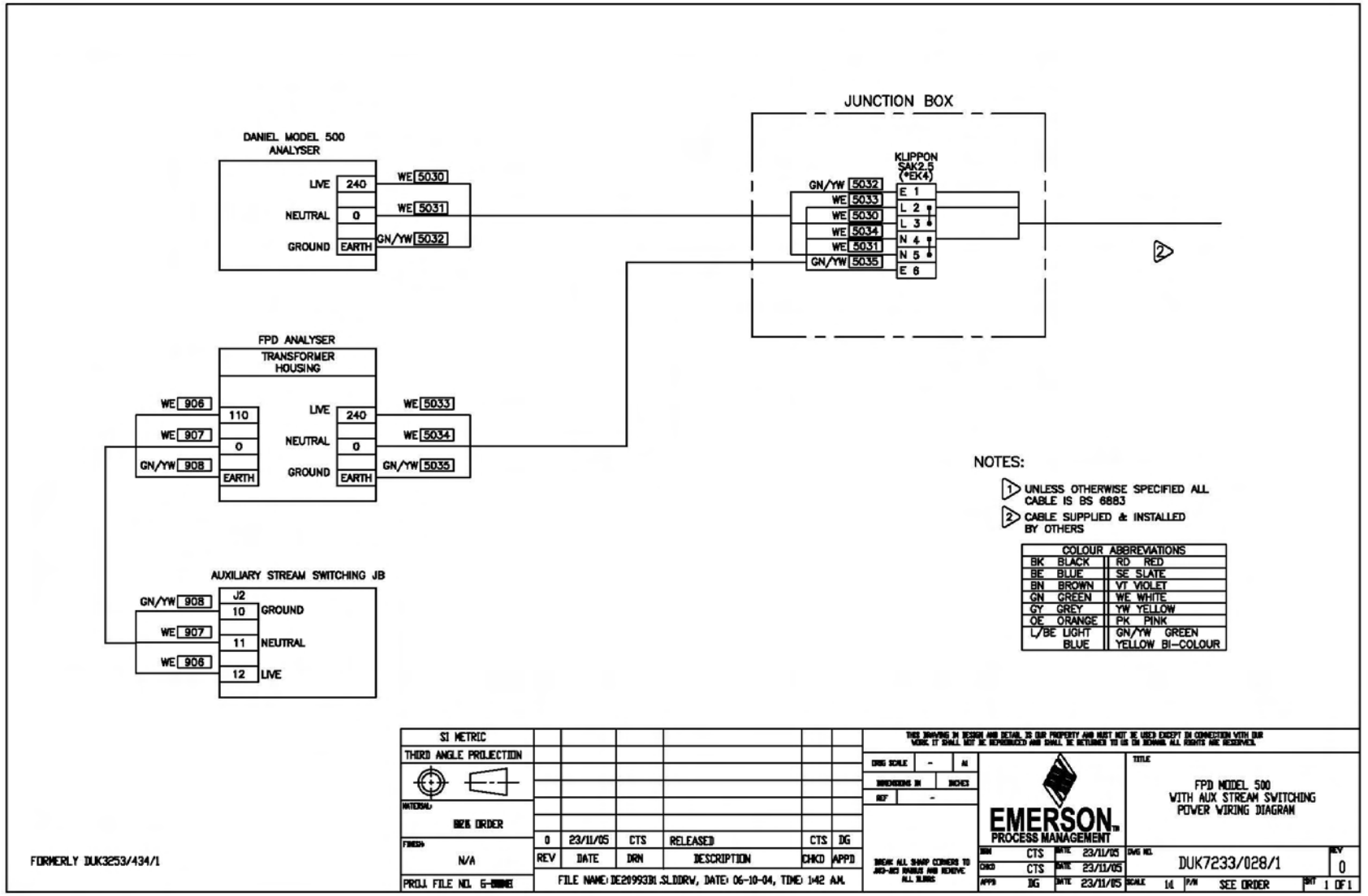
DRN	CTS	DATE	23/11/05
CHKD	CTS	DATE	23/11/05
APPD	DG	DATE	23/11/05

TITLE

ANALYSER MODEL 500 FPD
GENERAL ARRANGEMENT
DUAL ANALYSER

DWG NO. DUK7233/039/1 REV 2

SCALE 1:1 P/N SEE ORDER SHT 1 OF 1



FORMERLY DUK3253/434/1

SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: BRN ORDER						
FINISH: N/A						
PROJ. FILE NO. G-0000E						
	0	23/11/05	CTS	RELEASED	CTS	DG
	REV	DATE	DRN	DESCRIPTION	CHKD	APPD
	FILE NAME: DE209931.SLDDRW, DATE: 06-10-04, TIME: 1:42 A.M.					

DRG SCALE: - A4
DIMENSIONS IN: INCHES
REF: -

BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

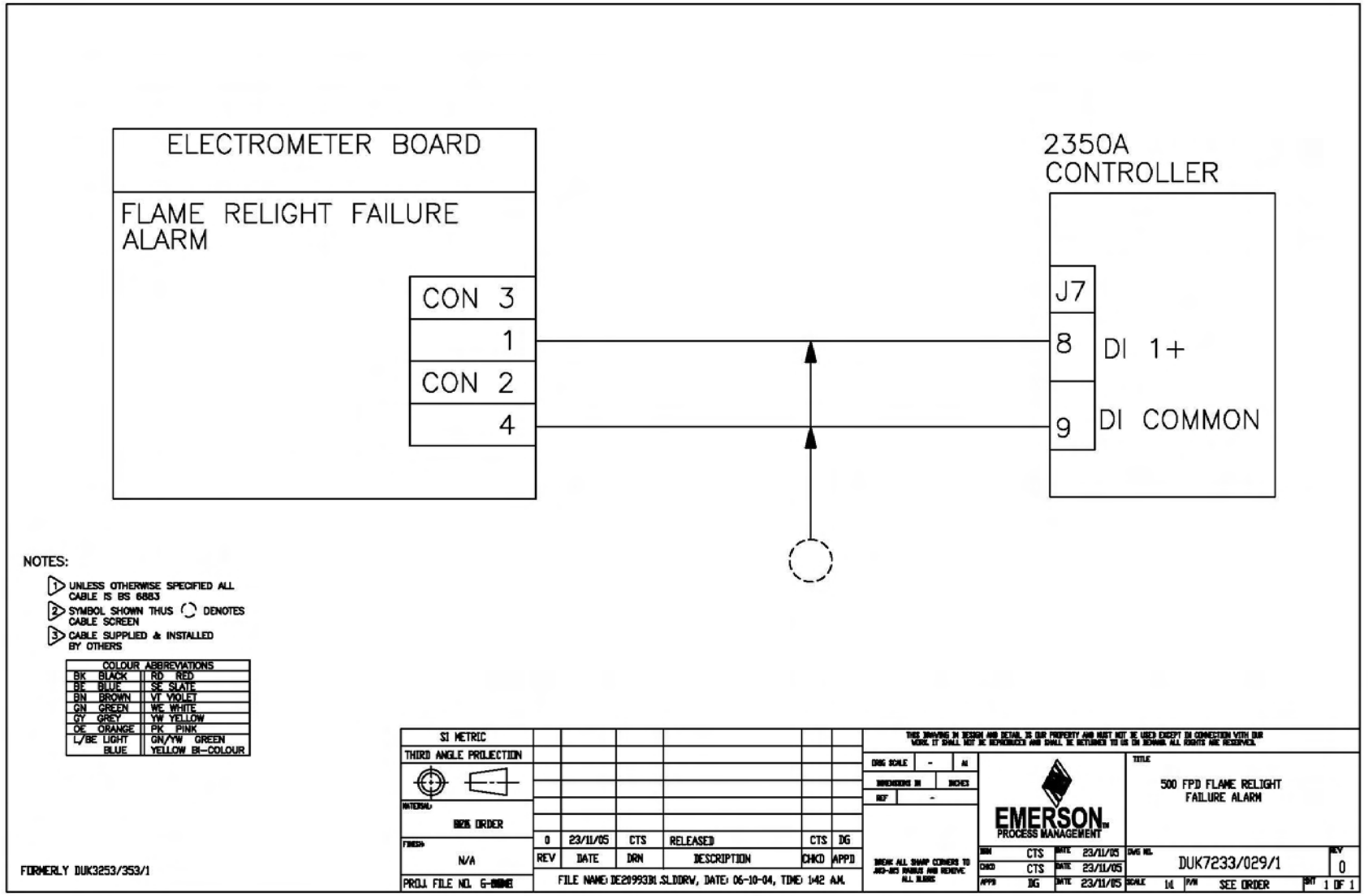
EMERSON. PROCESS MANAGEMENT

DRN	CTS	DATE 23/11/05
CHKD	CTS	DATE 23/11/05
APPD	DG	DATE 23/11/05

TITLE: FPD MODEL 500 WITH AUX STREAM SWITCHING POWER WIRING DIAGRAM

DWG NO. DUK7233/028/1 REV 0

SCALE 1:1 P/N SEE ORDER SHT 1 OF 1



NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL CABLE IS BS 6883
2. SYMBOL SHOWN THUS ◌ DENOTES CABLE SCREEN
3. CABLE SUPPLIED & INSTALLED BY OTHERS

COLOUR ABBREVIATIONS	
BK BLACK	RD RED
BE BLUE	SE SLATE
BN BROWN	VI VIOLET
GN GREEN	WE WHITE
GY GREY	YW YELLOW
OE ORANGE	PK PINK
L/BE LIGHT BLUE	GN/YW GREEN YELLOW BI-COLOUR

FORMERLY DUK3253/353/1

SI METRIC					
THIRD ANGLE PROJECTION					
MATERIAL: BOM ORDER					
FINISH: N/A	0	23/11/05	CTS	RELEASED	CTS DG
PROJ. FILE NO. G-00000	REV	DATE	DRN	DESCRIPTION	CHKD APPD

FILE NAME: DE20993B1.SLDDRW, DATE: 06-10-04, TIME: 1:42 A.M.

DRG SCALE: - A4
DIMENSIONS IN: INCHES
REF: -

BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

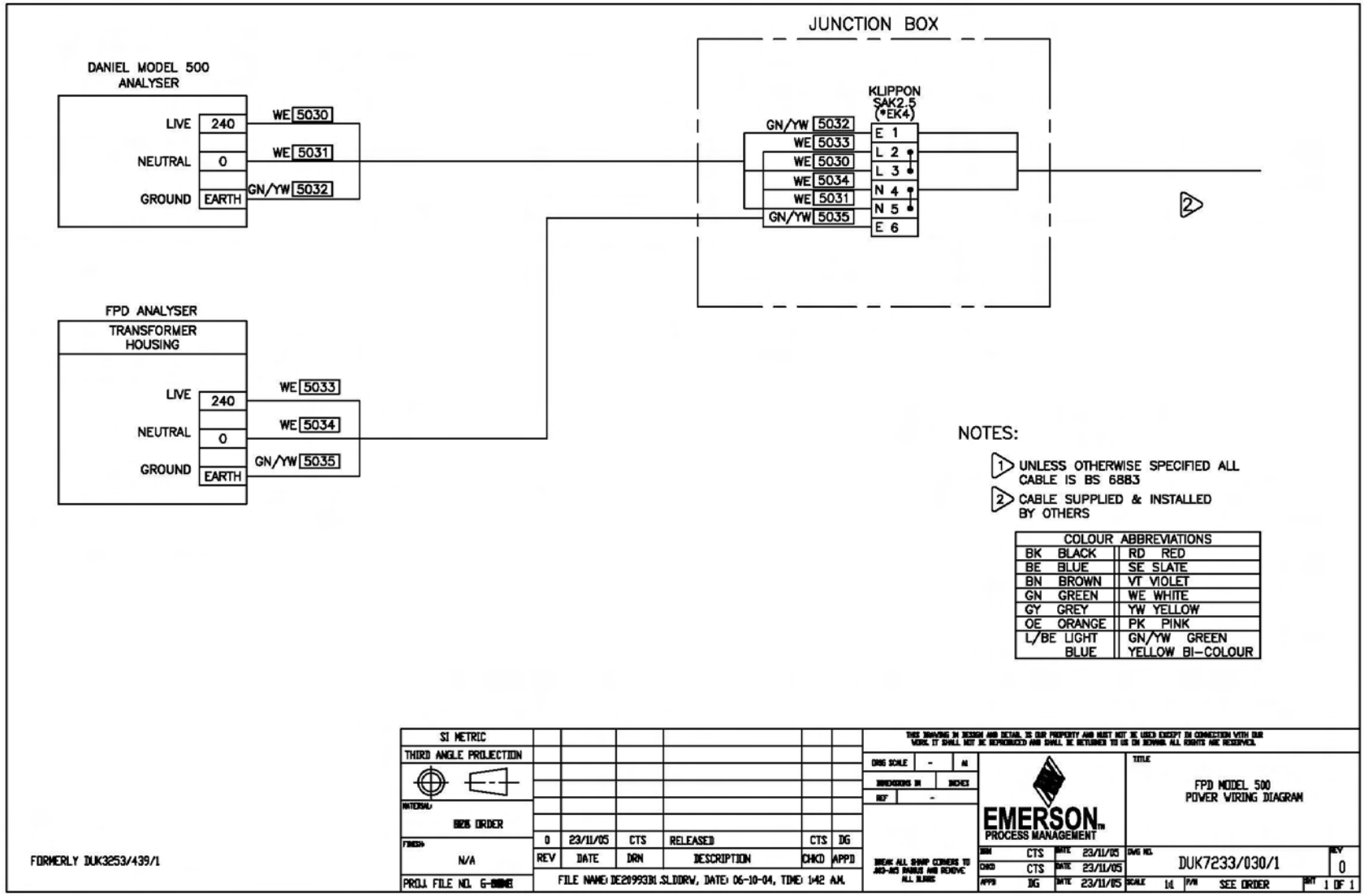
EMERSON. PROCESS MANAGEMENT

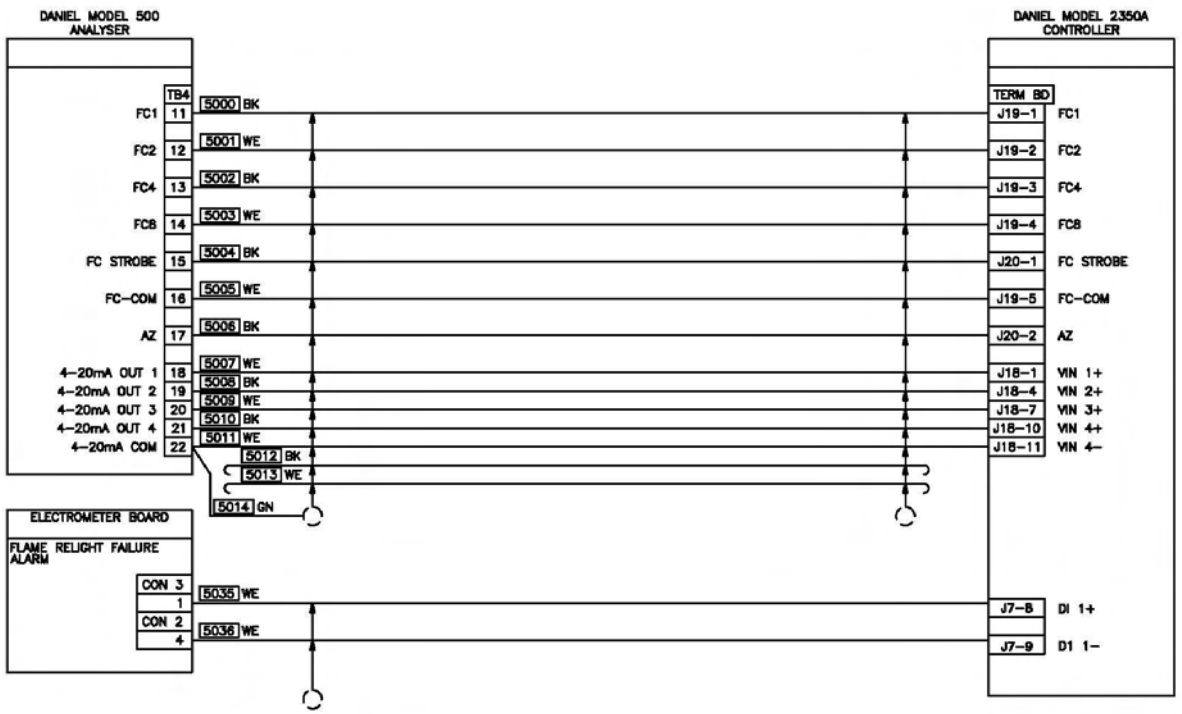
DRN	CTS	DATE	23/11/05
CHKD	CTS	DATE	23/11/05
APPD	DG	DATE	23/11/05

TITLE: 500 FPD FLAME RELIGHT FAILURE ALARM

DWG NO. DUK7233/029/1 REV 0

SCALE 1:1 P/N SEE ORDER SHT 1 OF 1


JUNCTION BOX
DANIEL MODEL 500
ANALYSER
LIVE
240
NEUTRAL
0
GROUND
EARTH
WE 5030
WE 5031
GN/YW 5032
KLIPPON
SAK2.5
(*EK4)
GN/YW 5032
WE 5033
WE 5030
WE 5034
WE 5031
GN/YW 5035
E 1
L 2
L 3
N 4
N 5
E 6
2
FPD ANALYSER
TRANSFORMER
HOUSING
LIVE
240
NEUTRAL
0
GROUND
EARTH
WE 5033
WE 5034
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
SI METRIC
THIRD ANGLE PROJECTION
MATERIAL
BOS ORDER
FINISH
N/A
PROJ FILE NO. G-0000E
0 23/11/05 CTS RELEASED CTS DG
REV DATE DRN DESCRIPTION CHKD APPD
FILE NAME: DE20993B1.SLDDRW, DATE: 06-10-04, TIME: 1:42 A.M.
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.
DRG SCALE - A4
DIMENSIONS IN INCHES
REF -
BREAK ALL SHARP CORNERS TO .003-.005 RADIUS AND REMOVE ALL BURRS
EMERSON PROCESS MANAGEMENT
DRN CTS DATE 23/11/05
CHKD CTS DATE 23/11/05
APPD DG DATE 23/11/05
TITLE
FPD MODEL 500
POWER WIRING DIAGRAM
DWG NO. DUK7233/030/1 REV 0
SCALE 1:1 P/N SEE ORDER SHT 1 OF 1
FORMERLY DUK3253/439/1



NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL CABLE TO BE BS 6883 - SUPPLIED BY OTHERS
2. SYMBOL SHOWN THUS ◯ DENOTES CABLE SCREEN

COLOUR ABBREVIATIONS			
BK	BLACK	RD	RED
BE	BLUE	SE	SLATE
BN	BROWN	VT	VIOLET
GN	GREEN	WE	WHITE
GY	GREY	YW	YELLOW
OE	ORANGE	PK	PINK
L/BE	LIGHT BLUE	GN/YW	GREEN YELLOW BI-COLOUR

FORMERLY DUK3253/365/1

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: SEE ORDER
FINISH: N/A
PROJ. FILE NO. G-000NE

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
0	23/11/05	CTS	RELEASED	CTS	DG

FILE NAME: DE209931.SLDDRW, DATE: 06-10-04, TIME: 1:42 A.M.

DRG SCALE: - A4
DIMENSIONS IN: INCHES
REF: -

BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

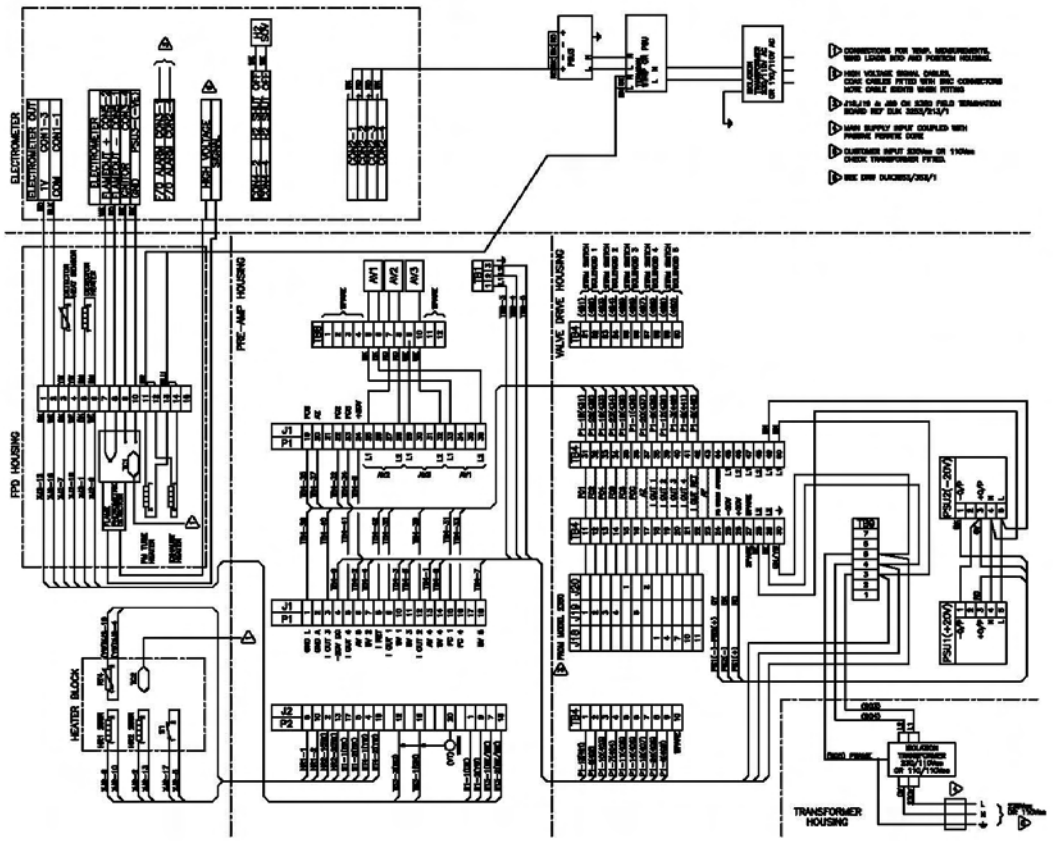
EMERSON. PROCESS MANAGEMENT

DRN	CTS	DATE	23/11/05
CHKD	CTS	DATE	23/11/05
APPD	DG	DATE	23/11/05

TITLE: DANIEL MDL 500FPD/MDL 2350A INTERCONNECTION DIAGRAM

DWG NO. DUK7233/033/1 REV 0

SCALE 1:1 P/N SEE ORDER SHT 1 OF 1



SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: SEE ORDER	1	15/05/07	CTS	ECN 2568/07D		
FINISH: N/A	0	23/11/05	CTS	RELEASED	CTS	DG
	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

FORMERLY DUK3253/355/1

DRG SCALE - A1
DIMENSIONS IN INCHES
REF -

BREAK ALL SHARP CORNERS TO 003-025 RADIUS AND REMOVE ALL BURRS

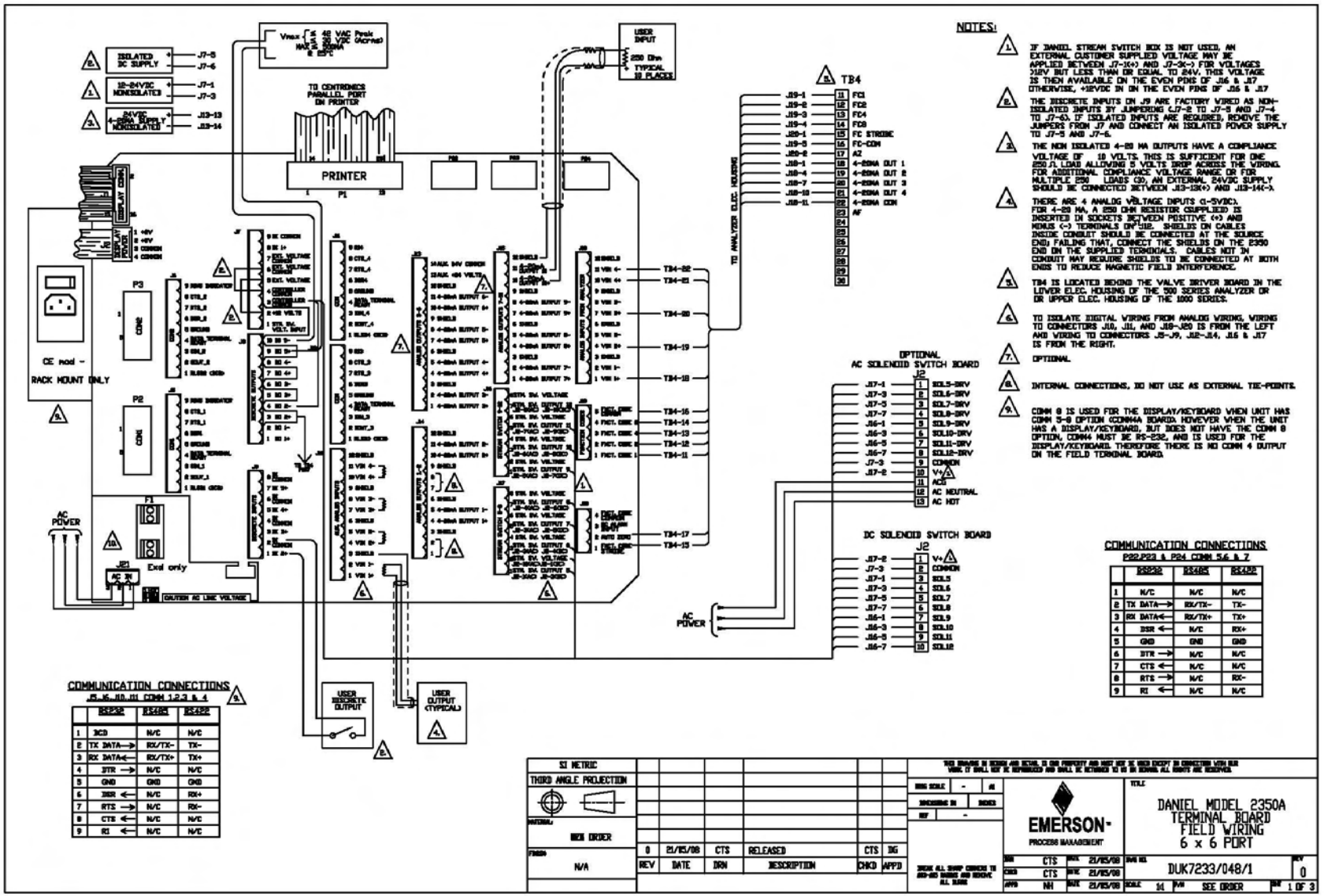
EMERSON PROCESS MANAGEMENT

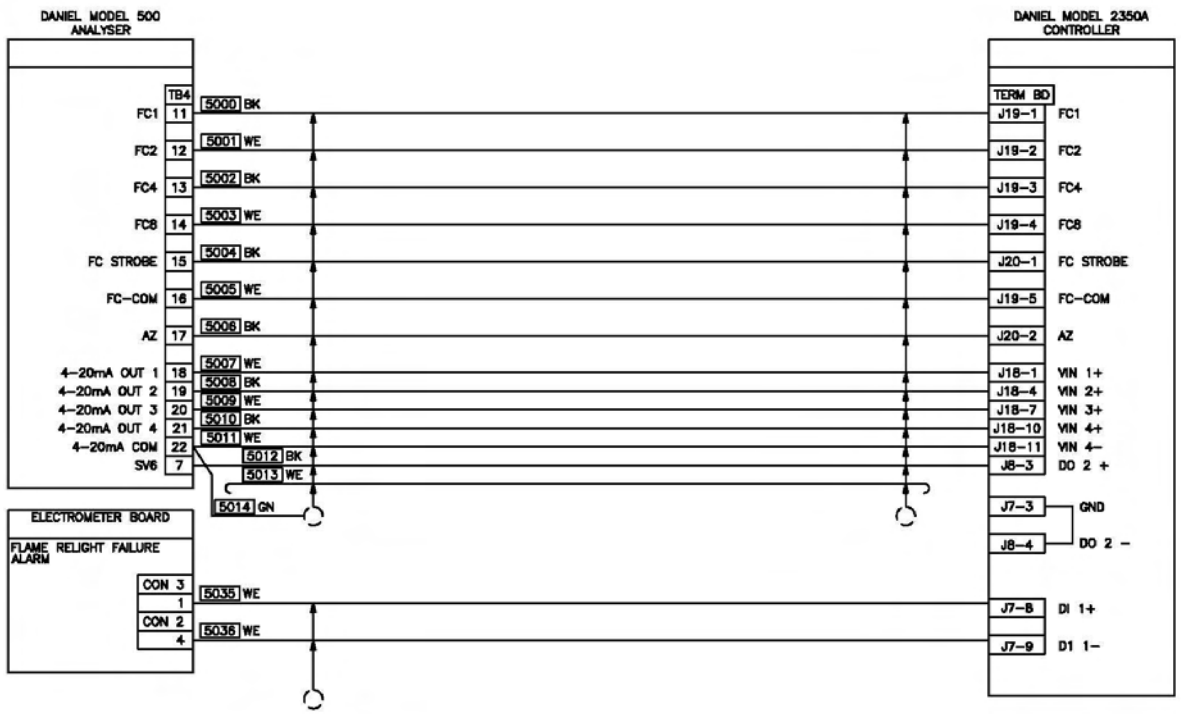
DRN	CTS	DATE	23/11/05
CHKD	CTS	DATE	23/11/05
APPD	DG	DATE	23/11/05

TITLE: WIRING DIAGRAM MODEL 500 FPD WITH 2350A CONTROLLER

DWG NO. DUK7233/034/1 REV 1

SCALE 1:1 PWR SEE ORDER SHT 1 OF 1


PRINTER
TO CENTRONICS PARALLEL PORT ON PRINTER
USER INPUT
250 Ohm TYPICAL 10 PLACES
TB4
TO ANALYZER ELEC. HOUSING
OPTIONAL AC SOLENOID SWITCH BOARD
DC SOLENOID SWITCH BOARD
AC POWER
CE mod - RACK MOUNT ONLY
USER DISCRETE OUTPUT
USER OUTPUT (TYPICAL)
NOTES:
1. IF DANIEL STREAM SWITCH BOX IS NOT USED, AN EXTERNAL CUSTOMER SUPPLIED VOLTAGE MAY BE APPLIED BETWEEN J7-1(+) AND J7-3(-) FOR VOLTAGES >18V BUT LESS THAN OR EQUAL TO 24V. THIS VOLTAGE IS THEN AVAILABLE ON THE EVEN PINS OF J16 & J17 OTHERWISE, +12VDC IN ON THE EVEN PINS OF J16 & J17
2. THE DISCRETE INPUTS ON J9 ARE FACTORY WIRED AS NON-ISOLATED INPUTS BY JUMPERING J17-2 TO J7-5 AND J7-4 TO J7-6. IF ISOLATED INPUTS ARE REQUIRED, REMOVE THE JUMPERS FROM J7 AND CONNECT AN ISOLATED POWER SUPPLY TO J7-5 AND J7-6.
3. THE NON ISOLATED 4-20 MA OUTPUTS HAVE A COMPLIANCE VOLTAGE OF 10 VOLTS THIS IS SUFFICIENT FOR ONE 250 Ω LOAD ALLOWING 5 VOLTS DROP ACROSS THE WIRING. FOR ADDITIONAL COMPLIANCE VOLTAGE RANGE OR FOR MULTIPLE 250 LOADS (3), AN EXTERNAL 24VDC SUPPLY SHOULD BE CONNECTED BETWEEN J13-13(+) AND J13-14(-).
4. THERE ARE 4 ANALOG VOLTAGE INPUTS (1-5VDC). FOR 4-20 MA, A 250 OHM RESISTOR (SUPPLIED) IS INSERTED IN SOCKETS BETWEEN POSITIVE (+) AND MINUS (-) TERMINALS ON J10. SHIELDS ON CABLES INSIDE CONDUIT SHOULD BE CONNECTED AT THE SOURCE END; FAILING THAT, CONNECT THE SHIELDS ON THE 2350 END ON THE SUPPLIED TERMINALS. CABLES NOT IN CONDUIT MAY REQUIRE SHIELDS TO BE CONNECTED AT BOTH ENDS TO REDUCE MAGNETIC FIELD INTERFERENCE.
5. TB4 IS LOCATED BEHIND THE VALVE DRIVER BOARD IN THE LOWER ELEC. HOUSING OF THE 500 SERIES ANALYZER OR OR UPPER ELEC. HOUSING OF THE 1000 SERIES.
6. TO ISOLATE DIGITAL WIRING FROM ANALOG WIRING, WIRING TO CONNECTORS J10, J11, AND J18-J20 IS FROM THE LEFT AND WIRING TO CONNECTORS J5-J9, J12-J14, J16 & J17 IS FROM THE RIGHT.
7. OPTIONAL
8. INTERNAL CONNECTIONS, DO NOT USE AS EXTERNAL TIE-POINTS.
9. COMM 0 IS USED FOR THE DISPLAY/KEYBOARD WHEN UNIT HAS COMM 5-8 OPTION (COMM4A BOARD). HOWEVER WHEN THE UNIT HAS A DISPLAY/KEYBOARD, BUT DOES NOT HAVE THE COMM 8 OPTION, COMM4 MUST BE RS-232, AND IS USED FOR THE DISPLAY/KEYBOARD. THEREFORE THERE IS NO COMM 4 OUTPUT ON THE FIELD TERMINAL BOARD.
COMMUNICATION CONNECTIONS
P22,P23 & P24 COMM 5,6 & 7
COMMUNICATION CONNECTIONS
J5,J6,J8,J11 COMM 1,2,3 & 4
SI METRIC
THIRD ANGLE PROJECTION
N/A
EMERSON
PROCESS MANAGEMENT
DANIEL MODEL 2350A TERMINAL BOARD FIELD WIRING 6 x 6 PORT
DUK7233/048/1
SEE ORDER
1 OF 3



NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL CABLE TO BE BS 6883 – SUPPLIED BY OTHERS
2. SYMBOL SHOWN THUS ◯ DENOTES CABLE SCREEN

COLOUR ABBREVIATIONS	
BK BLACK	RD RED
BE BLUE	SE SLATE
BN BROWN	VT VIOLET
GN GREEN	WE WHITE
GY GREY	YW YELLOW
OE ORANGE	PK PINK
L/BE LIGHT BLUE	GN/YW GREEN YELLOW BI-COLOUR

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BER ORDER
FINISH: N/A

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
0	21/05/08	CTS	RELEASED	CTS	NH

DRG SCALE - A1
DIMENSIONS IN INCHES
REF -

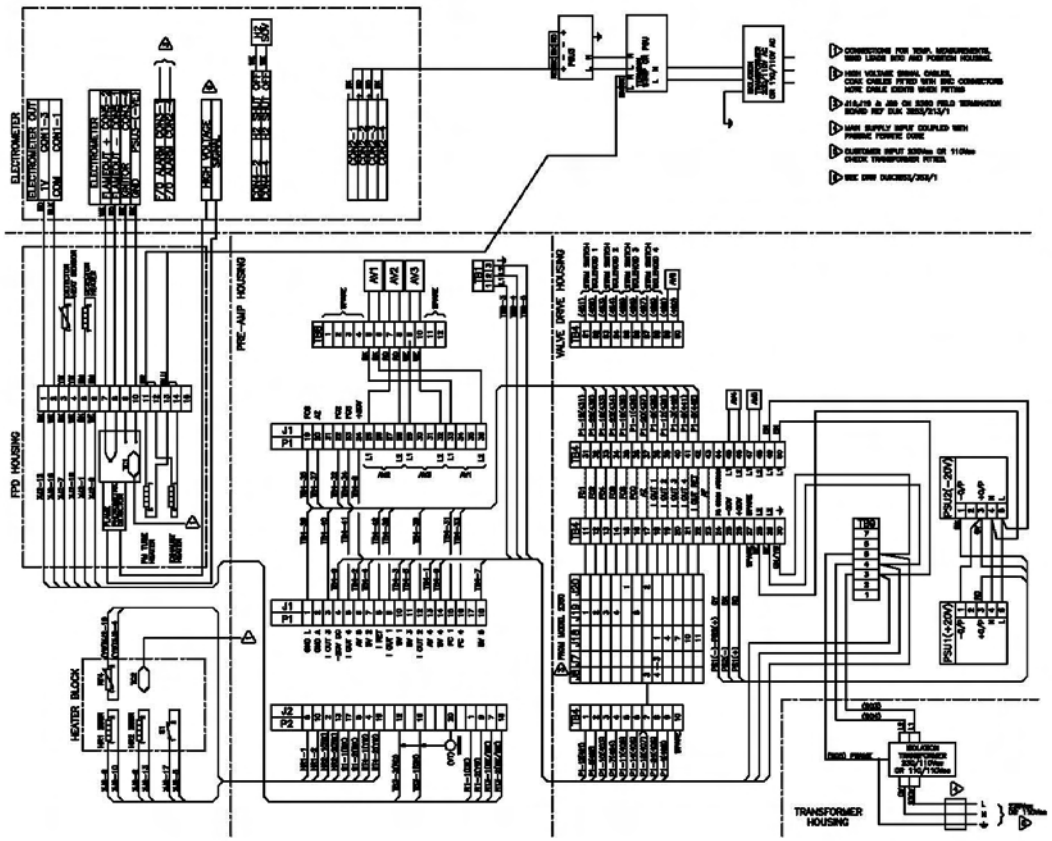
BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

EMERSON. PROCESS MANAGEMENT

TITLE: DANIEL MDL 500FPID/MDL 2350A INTERCONNECTION DIAGRAM 6 x 6 PORT

DRN	CTS	DATE	21/05/08
CHKD	CTS	DATE	21/05/08
APPD	NH	DATE	21/05/08

DWG NO. DUK7233/048/1 REV 0
SCALE 1:1 P/N SEE ORDER SHT 2 OF 3



0	21/05/08	CTS	RELEASED		CTS	NH
REV	DATE	DRN	DESCRIPTION		CHKD	APPD

SI METRIC

THIRD ANGLE PROJECTION

MATERIAL: SEE ORDER

FINISH: N/A

BREAK ALL SHARP CORNERS TO 203-025 RADIUS AND REMOVE ALL BURRS

DRG SCALE - A1

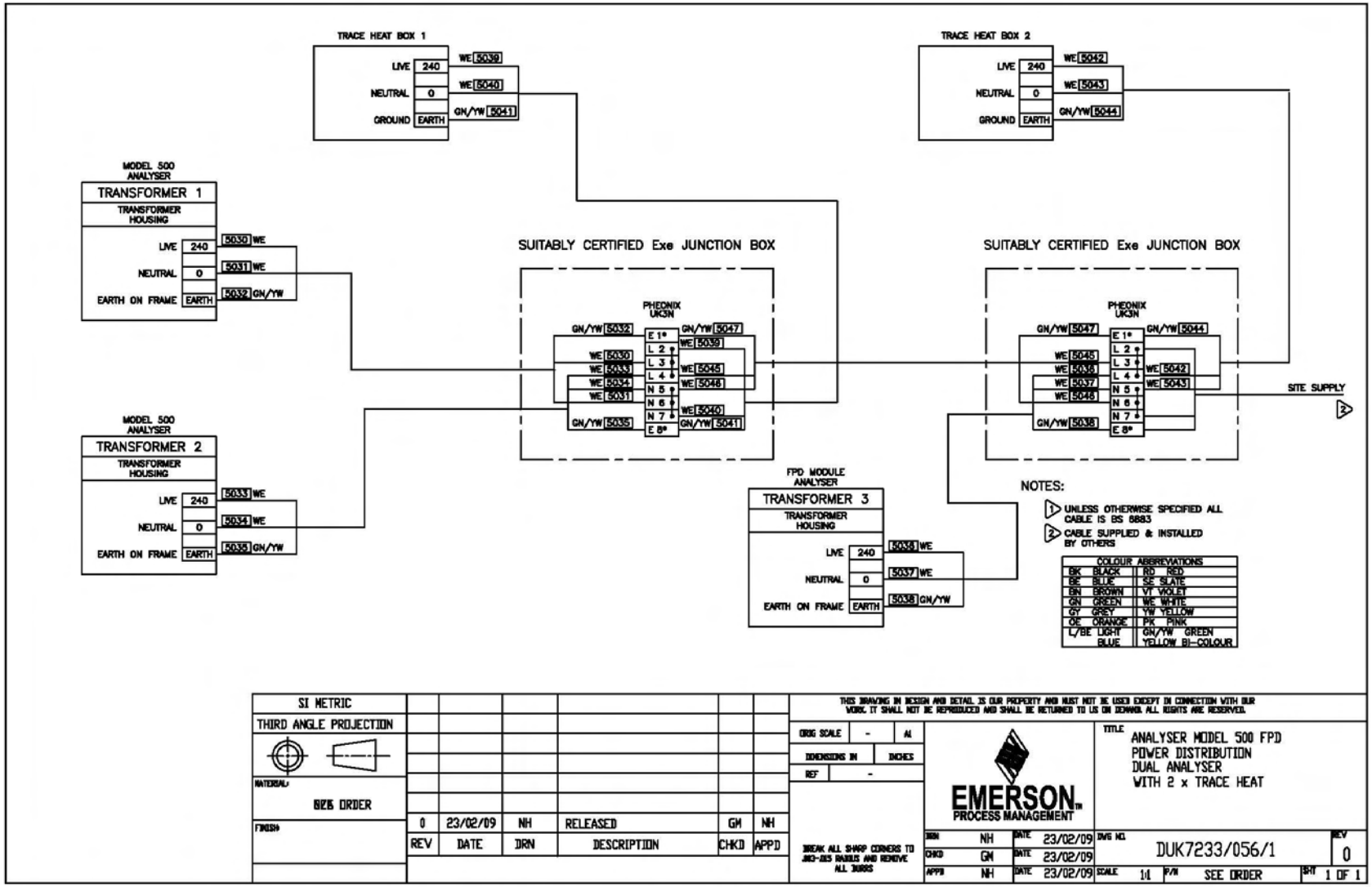
DIMENSIONS IN INCHES

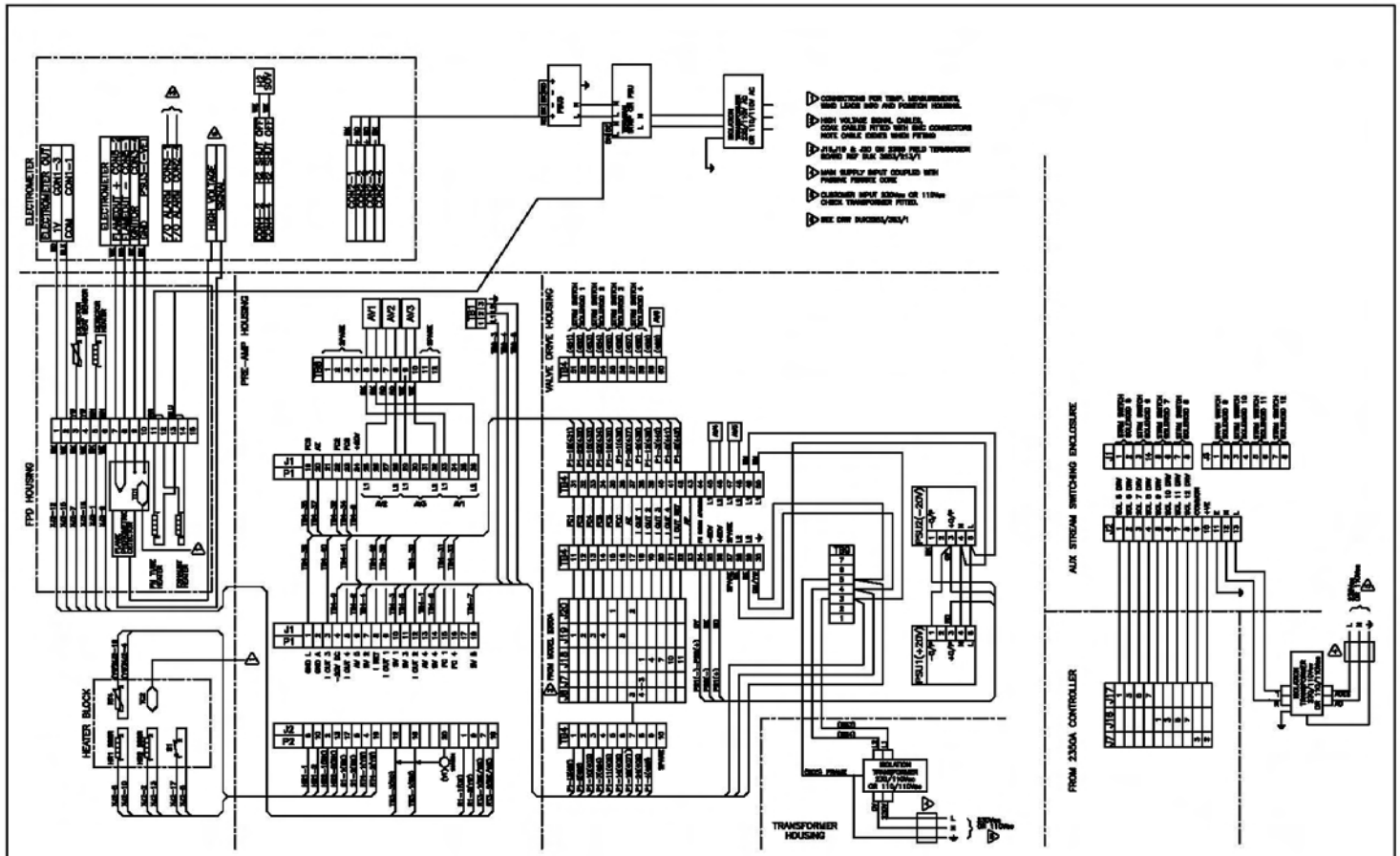
REF -

EMERSON PROCESS MANAGEMENT

TITLE: WIRING DIAGRAM MODEL 500 FPD WITH 2350A CONTROLLER 6 x 6 PORT VALVES

DRN	CTS	DATE 21/05/08	DWG NO: DUK7233/048/1 REV 0
CHKD	CTS	DATE 21/05/08	
APPD	NH	DATE 21/05/08	SCALE 1:1 P/N SEE ORDER SHT 3 OF 3


TRACE HEAT BOX 1
LIVE 240
NEUTRAL 0
GROUND EARTH
WE 5039
WE 5040
GN/YW 5041
TRACE HEAT BOX 2
LIVE 240
NEUTRAL 0
GROUND EARTH
WE 5042
WE 5043
GN/YW 5044
MODEL 500 ANALYSER
TRANSFORMER 1
TRANSFORMER HOUSING
LIVE 240
NEUTRAL 0
EARTH ON FRAME EARTH
5030 WE
5031 WE
5032 GN/YW
SUITABLY CERTIFIED Exe JUNCTION BOX
PHOENIX UK3N
GN/YW 5032
WE 5030
WE 5033
WE 5034
WE 5031
GN/YW 5035
E 1*
L 2
L 3
L 4
N 5
N 6
N 7
E 8*
GN/YW 5047
WE 5039
WE 5045
WE 5048
WE 5040
GN/YW 5041
SUITABLY CERTIFIED Exe JUNCTION BOX
PHOENIX UK3N
GN/YW 5047
WE 5045
WE 5036
WE 5037
WE 5046
GN/YW 5038
E 1*
L 2
L 3
L 4
N 5
N 6
N 7
E 8*
GN/YW 5044
WE 5042
WE 5043
SITE SUPPLY
A
MODEL 500 ANALYSER
TRANSFORMER 2
TRANSFORMER HOUSING
LIVE 240
NEUTRAL 0
EARTH ON FRAME EARTH
5033 WE
5034 WE
5035 GN/YW
FPD MODULE ANALYSER
TRANSFORMER 3
TRANSFORMER HOUSING
LIVE 240
NEUTRAL 0
EARTH ON FRAME EARTH
5036 WE
5037 WE
5038 GN/YW
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
VI VIOLET
WE WHITE
YW YELLOW
PK PINK
GN/YW GREEN YELLOW BI-COLOUR
SI METRIC
THIRD ANGLE PROJECTION
MATERIAL
SEE ORDER
FINISH
REV DATE DRN DESCRIPTION CHKD APPD
0 23/02/09 NH RELEASED GM NH
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.
ORG SCALE - A1
DIMENSIONS IN INCHES
REF -
BREAK ALL SHARP CORNERS TO .003-.005 RADIUS AND REMOVE ALL BURRS
EMERSON PROCESS MANAGEMENT
DRN NH DATE 23/02/09
CHKD GM DATE 23/02/09
APPD NH DATE 23/02/09
TITLE
ANALYSER MODEL 500 FPD
POWER DISTRIBUTION
DUAL ANALYSER
WITH 2 x TRACE HEAT
DWG NO. DUK7233/056/1
REV 0
SCALE 1:1 F/N SEE ORDER SHT 1 OF 1



SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: SEE ORDER						
FINISH: N/A						
	0	12/06/09	NH	RELEASED	GM	NH
	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

DRG SCALE - A1
DIMENSIONS IN INCHES
REF -

BREAK ALL SHARP CORNERS TO .003-.025 RADIUS AND REMOVE ALL BURRS

EMERSON PROCESS MANAGEMENT

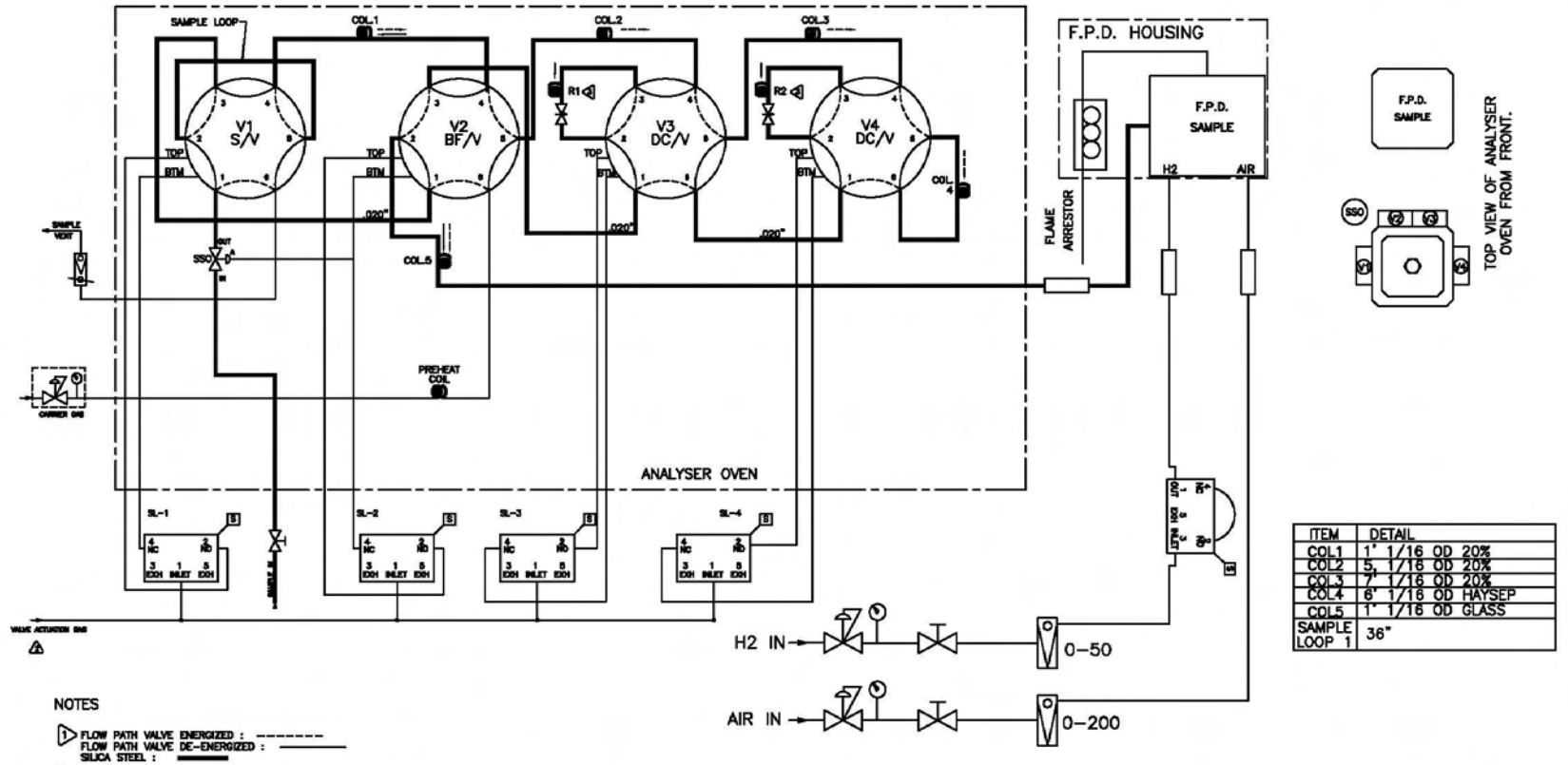
DRN	NH	DATE	12/06/09
CHKD	GM	DATE	12/06/09
APPD	NH	DATE	12/06/09

TITLE: WIRING DIAGRAM
MODEL 500 FPD WITH
2350A CONTROLLER
6 x 6 PORT VALVES
C/W AUX STREAM SWITCHING

DWG NO. DUK7233/062/1 REV 0

SCALE 1:1 PWR SEE ORDER SHT 1 OF 1

PARENT No 09210 0135



ITEM	DETAIL
COL1	1' 1/16 OD 20%
COL2	5' 1/16 OD 20%
COL3	7' 1/16 OD 20%
COL4	6' 1/16 OD HAYSEP
COL5	1' 1/16 OD GLASS
SAMPLE LOOP 1	36"

NOTES

1. FLOW PATH VALVE ENERGIZED : --------
   FLOW PATH VALVE DE-ENERGIZED : ————
   SILICA STEEL : ▬▬
2. ON SOME ANALYSERS A COMMON CARRIER/ACTUATION GAS INLET MAY BE USED
3. RESTRICTOR COLUMN 1 MATCHES RESTRICTION OF COLUMN 3 & 4
   RESTRICTOR COLUMN 2 MATCHES RESTRICTION OF COLUMN 4

FORMERLY DUK3253/437/1

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
0	23/11/05	CTS	RELEASED	CTS	DG

FILE NAME: DE209931.SLDDRW, DATE: 06-10-04, TIME: 142 A.M.

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BOM ORDER
FINISH: N/A
PROJ. FILE NO. G-BOOM

DRG SCALE: - A1
DIMENSIONS IN: INCHES
REF: -

BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

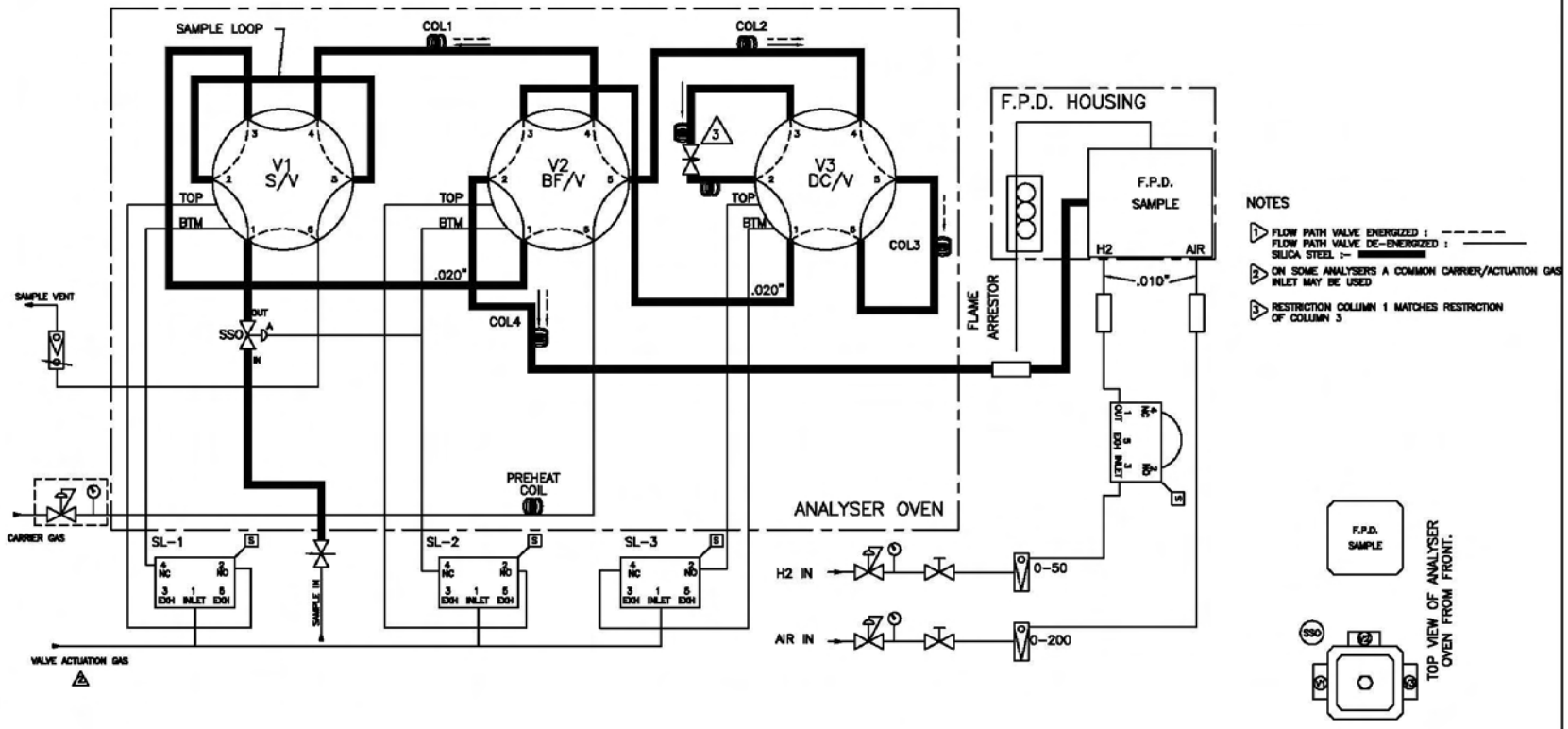
EMERSON PROCESS MANAGEMENT

DRN	CTS	23/11/05
CHKD	CTS	23/11/05
APPD	DG	23/11/05

TITLE: FLOW DIAGRAM MODEL 500 FPD TBM/THT

DWG NO. DUK7233/031/1 REV 0
SCALE 1:4 P/N SEE ORDER SHT 1 OF 1

PARENT No 09210 0134



SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: BEN ORDER	1	23/11/06	CTS	ECN2635/06	CTS	DG
FINISH: N/A	0	23/11/05	CTS	RELEASED	CTS	DG
	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

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DRG SCALE - A4
DIMENSIONS IN INCHES
REF -

BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

EMERSON PROCESS MANAGEMENT

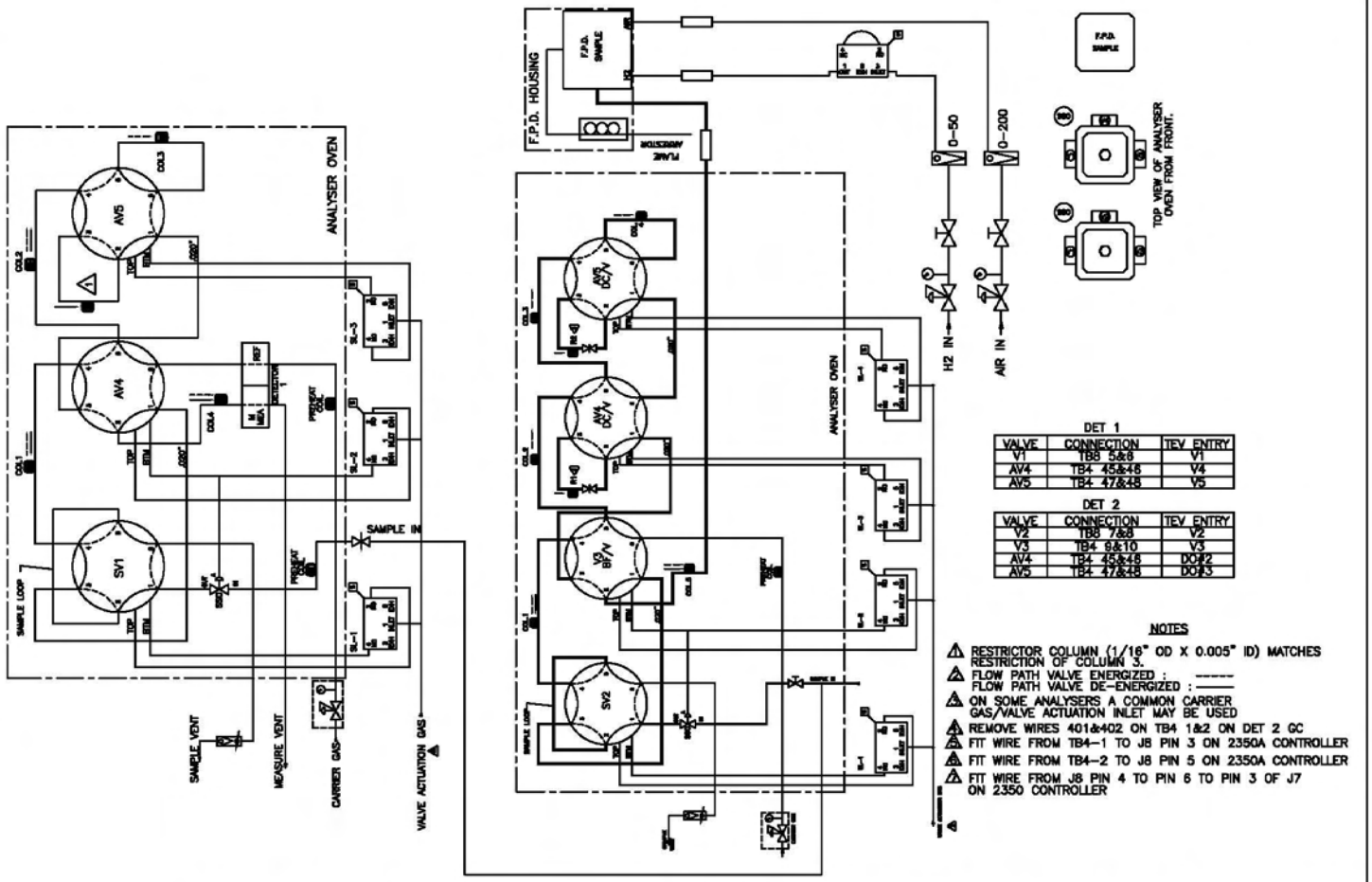
DRN	CTS	DATE	23/11/05
CHKD	CTS	DATE	23/11/05
APPD	DG	DATE	23/11/05

TITLE: FLOW DIAGRAM MODEL 500 FPD SULPHUR

DWG NO. DUK7233/032/1 REV 1

SCALE 1:1 P/N SEE ORDER SHT 1 OF 1

FORMERLY DUK3253/438/1



DET 1

VALVE	CONNECTION	TEV ENTRY
V1	TB8 5&6	V1
AV4	TB4 45&46	V4
AV5	TB4 47&48	V5

DET 2

VALVE	CONNECTION	TEV ENTRY
V2	TB8 7&8	V2
V3	TB4 9&10	V3
AV4	TB4 45&46	DO#2
AV5	TB4 47&48	DO#3

NOTES

1. RESTRICTOR COLUMN (1/16" OD X 0.005" ID) MATCHES RESTRICTION OF COLUMN 3.
2. FLOW PATH VALVE ENERGIZED : -----
   FLOW PATH VALVE DE-ENERGIZED : ——
3. ON SOME ANALYSERS A COMMON CARRIER GAS/VALVE ACTUATION INLET MAY BE USED
4. REMOVE WIRES 401&402 ON TB4 1&2 ON DET 2 GC
5. FIT WIRE FROM TB4-1 TO J8 PIN 3 ON 2350A CONTROLLER
6. FIT WIRE FROM TB4-2 TO J8 PIN 5 ON 2350A CONTROLLER
7. FIT WIRE FROM J8 PIN 4 TO PIN 6 TO PIN 3 OF J7 ON 2350 CONTROLLER

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BOS ORDER
FINISH:

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
3	03/03/08	CTS	ECN 2517/08	CTS	GM
2	28/03/07	CTS	ECN 2551/07	CTS	GM
1	19/03/07	CTS	ECN 2543/07	CTS	GM
0	23/11/05	CTS	RELEASED	CTS	DG

GEN SCALE - NL
DIMENSIONS IN INCHES
REF -

BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

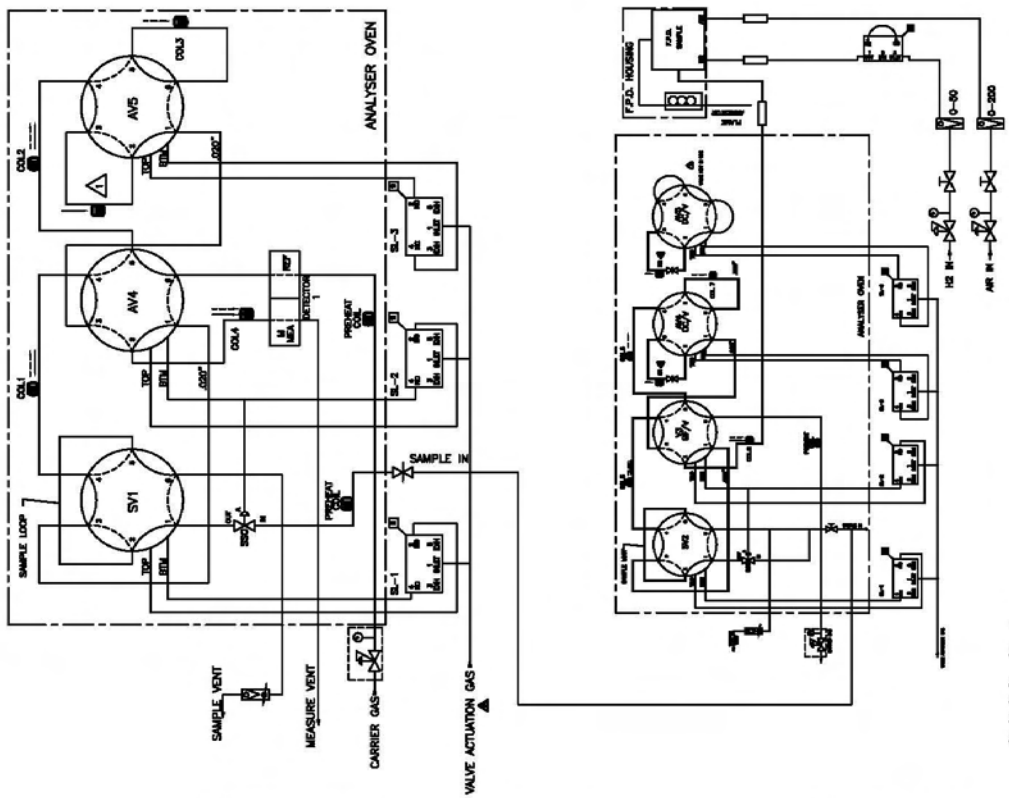
EMERSON PROCESS MANAGEMENT

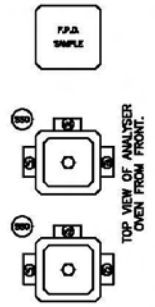
TITLE: FLOW DIAGRAM MODEL 500 FPD C6+/ SULPHUR

DRN	CTS	DATE	23/11/05
CHKD	CTS	DATE	23/11/05
APPD	DG	DATE	23/11/05

DWG NO. DUK7233/035/1 REV 3
SCALE NTS PVR SEE ORDER SHT 1 OF 1

FORMERLY DUK3253/360/1





ITEM	DETAIL
COL5	1' 1/16 OD 20% OV17
COL6	10' 1/16 OD 20% OV17
COL7	6' 1/160D HAYSEP Q
COL8	1' 1/160D GLASS BEADS
SAMPLE LOOP 1	36"

DET 1

VALUE	CONNECTION	TEV ENTRY
V1	TB8 5&6	V1
AV4	TB4 45&46	V4
AV5	TB4 47&48	V5

DET 2

VALUE	CONNECTION	TEV ENTRY
V2	TB8 7&8	V2
V3	TB4 9&10	V3
AV4	TB4 45&46	DO#2
AV5	TB4 47&48	DO#3

NOTES

1. RESTRICTOR COLUMN (1/16" OD X 0.005" ID) MATCHES RESTRICTION OF COLUMN 3.
2. FLOW PATH VALVE ENERGIZED :------
   FLOW PATH VALVE DE-ENERGIZED :———
3. ON SOME ANALYSERS A COMMON CARRIER GAS/VALVE ACTUATION INLET MAY BE USED
4. REMOVE WIRES 401&402 ON TB4 1&2 ON DET 2 GC
5. FIT WIRE FROM TB4-1 TO J8 PIN 3 ON 2350A CONTROLLER
6. FIT WIRE FROM TB4-2 TO J8 PIN 5 ON 2350A CONTROLLER
7. FIT WIRE FROM J8 PIN 4 TO PIN 6 TO PIN 3 OF J7 ON 2350 CONTROLLER

0	23/11/05	CTS	RELEASED	CTS	DG
REV	DATE	DRN	DESCRIPTION	CHKD	APPD

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BOM ORDER
FINISH:

DRG SCALE - A1
DIMENSIONS IN INCHES
REF -

BREAK ALL SHARP CORNERS TO .003-.013 RADIUS AND REMOVE ALL BURRS

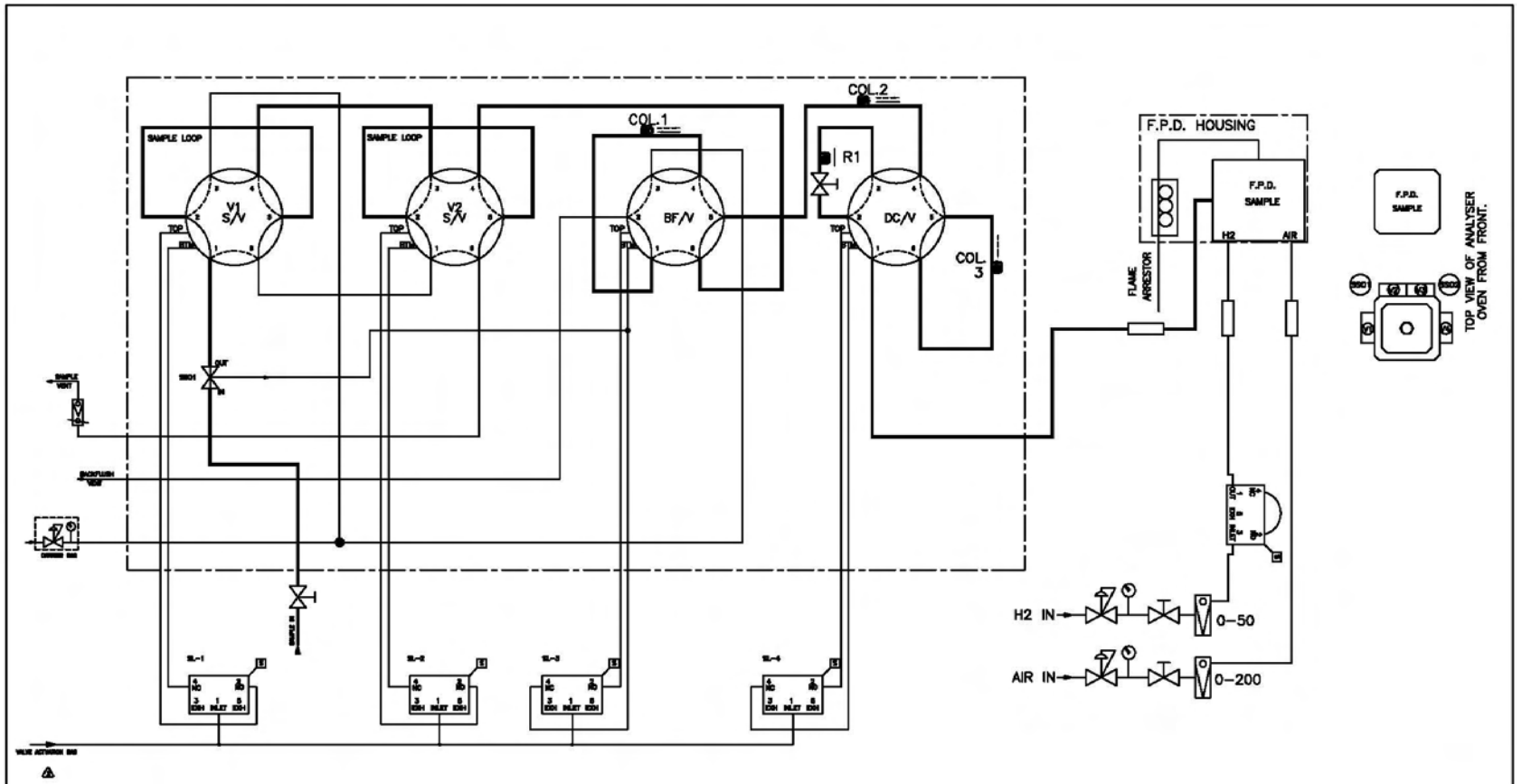
EMERSON PROCESS MANAGEMENT

TITLE: FLOW DIAGRAM MODEL 500 FPD C6+/ SULPHUR

DRN	CTS	DATE	23/11/05
CHKD	CTS	DATE	23/11/05
APPD	DG	DATE	23/11/05

DWG NO. DUK7233/045/1 REV 0
SCALE NTS P/N SEE ORDER SHT 1 OF 1

FORMERLY DUK3253/360/1



NOTES

1. FLOW PATH VALVE ENERGIZED : ---------
   FLOW PATH VALVE DE-ENERGIZED : ———
   SILICA STEEL : ———
2. ON SOME ANALYSERS A COMMON CARRIER/ACTUATION GAS INLET MAY BE USED
3. RESTRICTOR COLUMN 1 MATCHES RESTRICTION OF COLUMN 3

SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: SEE ORDER						
FINISH: N/A	0	12/05/08	CTS	RELEASED	CTS	NH
	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

BREAK ALL SHARP CORNERS TO .005–.015 RADIUS AND REMOVE ALL BURRS

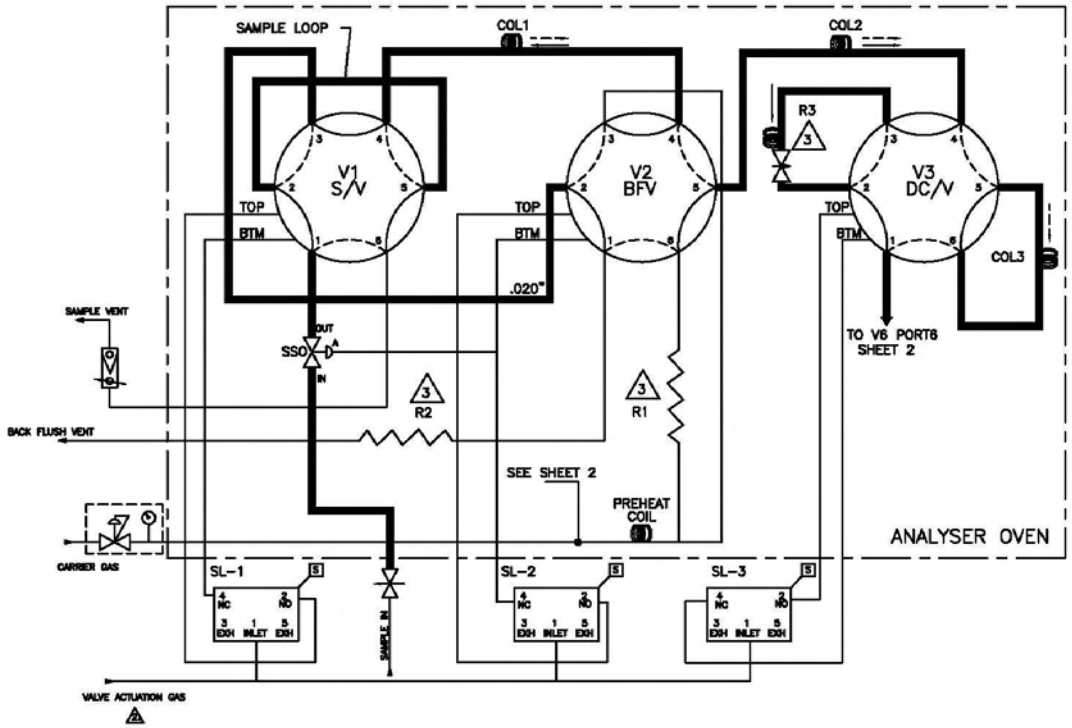
EMERSON PROCESS MANAGEMENT

DRN	CTS	DATE	12/05/08
CHKD	CTS	DATE	12/05/08
APPD	NH	DATE	12/05/08

TITLE: FLOW DIAGRAM MODEL 500 FPD DUAL RANGE DMS

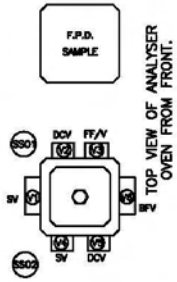
DWG NO. DUK7233/046/1 REV 0

SCALE NTS SIZE SEE ORDER SHT 1 OF 1



NOTES

1. FLOW PATH VALVE ENERGIZED : - - - - -
   FLOW PATH VALVE DE-ENERGIZED : ———
   SILICA STEEL :-
2. ON SOME ANALYSERS A COMMON CARRIER/ACTUATION GAS INLET MAY BE USED
3. BALANCE FLOW RATES
   - R1= MATCHES RESTRICTION OF COL1
   - R2= MATCHES RESTRICTION OF COL2 + COL3
   - R3= MATCHES RESTRICTION OF COL3



TOP VIEW OF ANALYSER OVEN FROM FRONT.

2	15/12/08	NH	ECN 2589/08		GM	NH
1	18/08/08	RRB	RELEASED		GM	NH
0	21/05/08	CTS	RELEASED		CTS	NH
REV	DATE	DRN	DESCRIPTION		CHKD	APPD

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: SEE ORDER
FINISH: N/A
BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

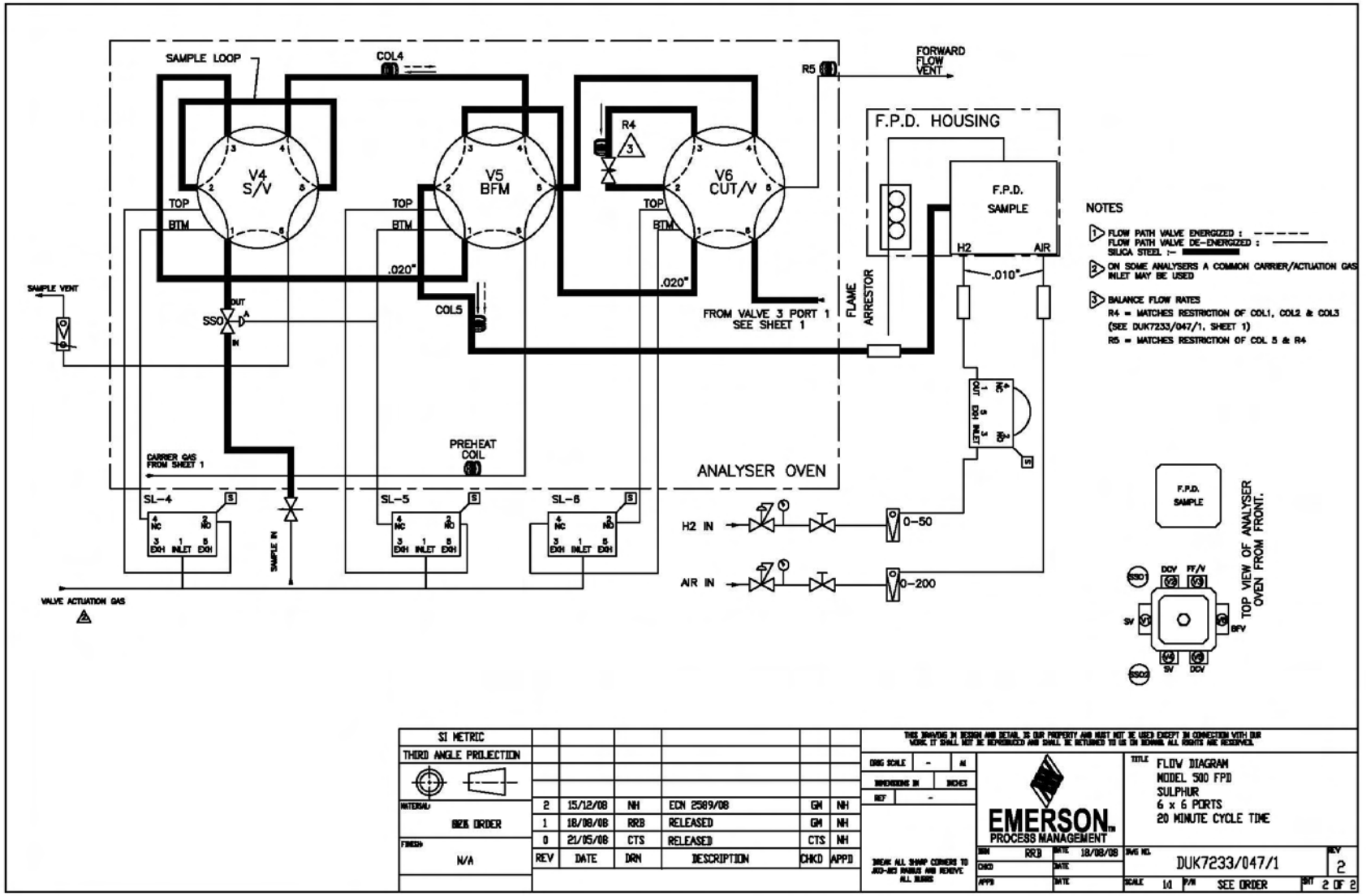
DRG SCALE: - A1
DIMENSIONS IN: INCHES
REF: -

EMERSON PROCESS MANAGEMENT

DRN RRB DATE 18/081/08
CHKD DATE
APPD DATE

TITLE: FLOW DIAGRAM
MODEL 500 FPD
SULPHUR
6 x 6 PORTS
20 MINUTE CYCLE TIME

DWG NO. DUK7233/047/1 REV 2
SCALE 1:1 P/N SEE ORDER SHT 1 OF 2



REV	DATE	DRN	DESCRIPTION	CHKD	APPD
2	15/12/08	NH	ECN 2589/08	GM	NH
1	18/08/08	RRB	RELEASED	GM	NH
0	21/05/08	CTS	RELEASED	CTS	NH

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BEK ORDER
FINISH: N/A

DRG SCALE - A4
DIMENSIONS IN INCHES
REF -

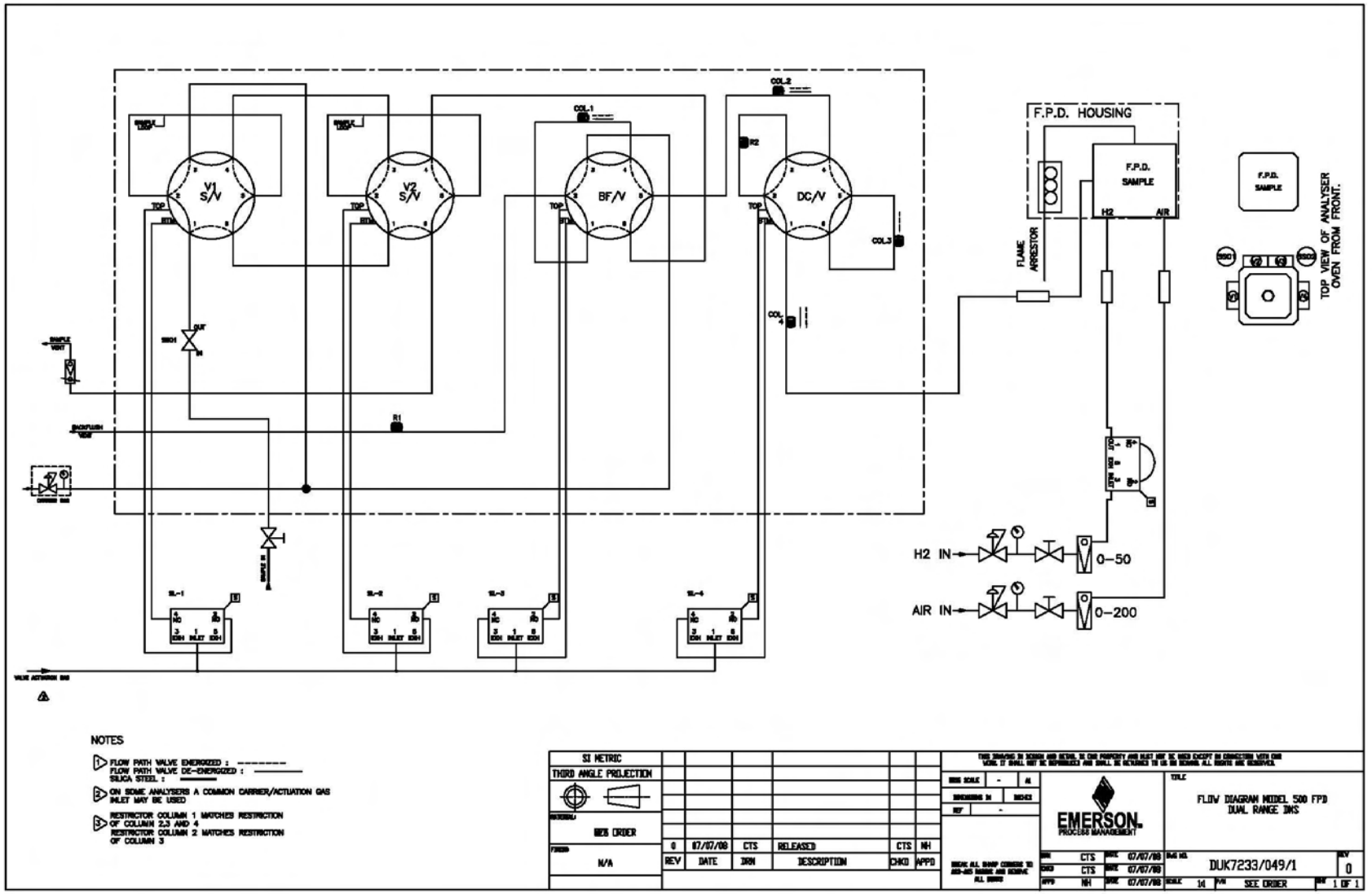
BREAK ALL SHARP CORNERS TO .003-.005 RADIUS AND REMOVE ALL BURRS

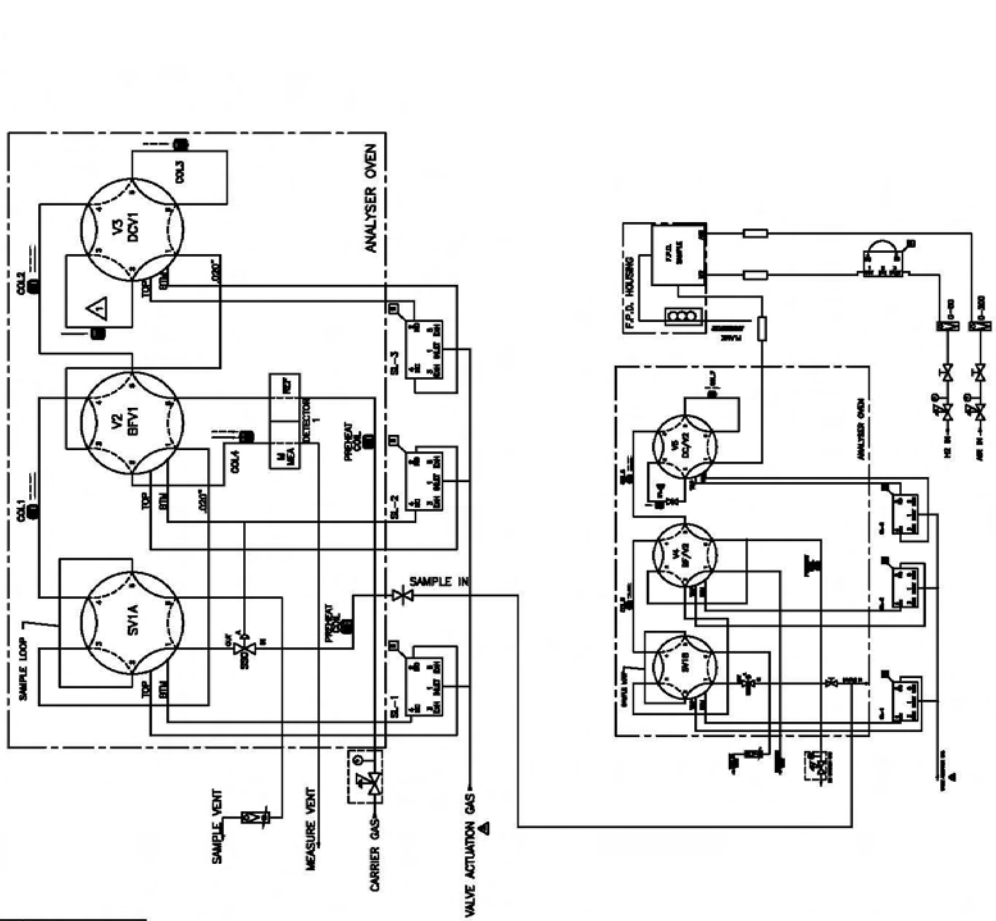
EMERSON PROCESS MANAGEMENT

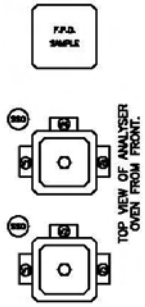
DRN RRB DATE 18/08/08
CHKD DATE
APPD DATE

TITLE: FLOW DIAGRAM
MODEL 500 FPD
SULPHUR
6 x 6 PORTS
20 MINUTE CYCLE TIME

DWG NO. DUK7233/047/1 REV 2
SCALE 1:1 P/N SEE ORDER SHT 2 OF 2


F.P.D. HOUSING
F.P.D. SAMPLE
H2
AIR
FLAME ARRESTOR
TOP VIEW OF ANALYSER OVEN FROM FRONT.
V1 S/V
V2 S/V
BF/V
DC/V
COL.1
COL.2
COL.3
COL.4
R1
R2
H2 IN
AIR IN
0–50
0–200
NOTES
FLOW PATH VALVE ENERGIZED : ---------
FLOW PATH VALVE DE-ENERGIZED : ———
SILICA STEEL : ———
ON SOME ANALYSERS A COMMON CARRIER/ACTUATION GAS INLET MAY BE USED
RESTRICTOR COLUMN 1 MATCHES RESTRICTION OF COLUMN 2,3 AND 4
RESTRICTOR COLUMN 2 MATCHES RESTRICTION OF COLUMN 3
SI METRIC
THIRD ANGLE PROJECTION
SEE ORDER
N/A
0 07/07/08 CTS RELEASED CTS NH
REV DATE DRN DESCRIPTION CHKD APPD
EMERSON PROCESS MANAGEMENT
FLOW DIAGRAM MODEL 500 FPD DUAL RANGE DMS
DUK7233/049/1
0
SEE ORDER
1 OF 1





ITEM	DETAIL
COL5	1'20% OV17 SILCOPORT P
COL6	9'20% OV17 SILCOPORT P
COL7	6" 1/160D HAYSEP Q
COL8	1' 1/160D GLASS BEADS
SAMPLE LOOP 1	6"

NOTES

1. RESTRICTOR COLUMN (1/16" OD X 0.005" ID) MATCHES RESTRICTION OF COLUMN 3.
2. FLOW PATH VALVE ENERGIZED :------
   FLOW PATH VALVE DE-ENERGIZED :——
3. ON SOME ANALYSERS A COMMON CARRIER GAS/VALVE ACTUATION INLET MAY BE USED

ITEM	DETAIL
COL1	12" opn silc
COL2	7' 20% sf-96 c/sf
COL3	7' Haysep N silcoport p
COL4	6"5% CW-20m silcoport p
SAMPLE LOOP	6"

FORMERLY DUK3253/360/1

SI METRIC

THIRD ANGLE PROJECTION

MATERIAL: BOM ORDER

FINISH:

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
1	28/08/08	CTS	ECN 2658/08	CTS	NH
0	09/07/08	CTS	RELEASED	CTS	NH

DRG SCALE - A1

DIMENSIONS IN INCHES

REF -

BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

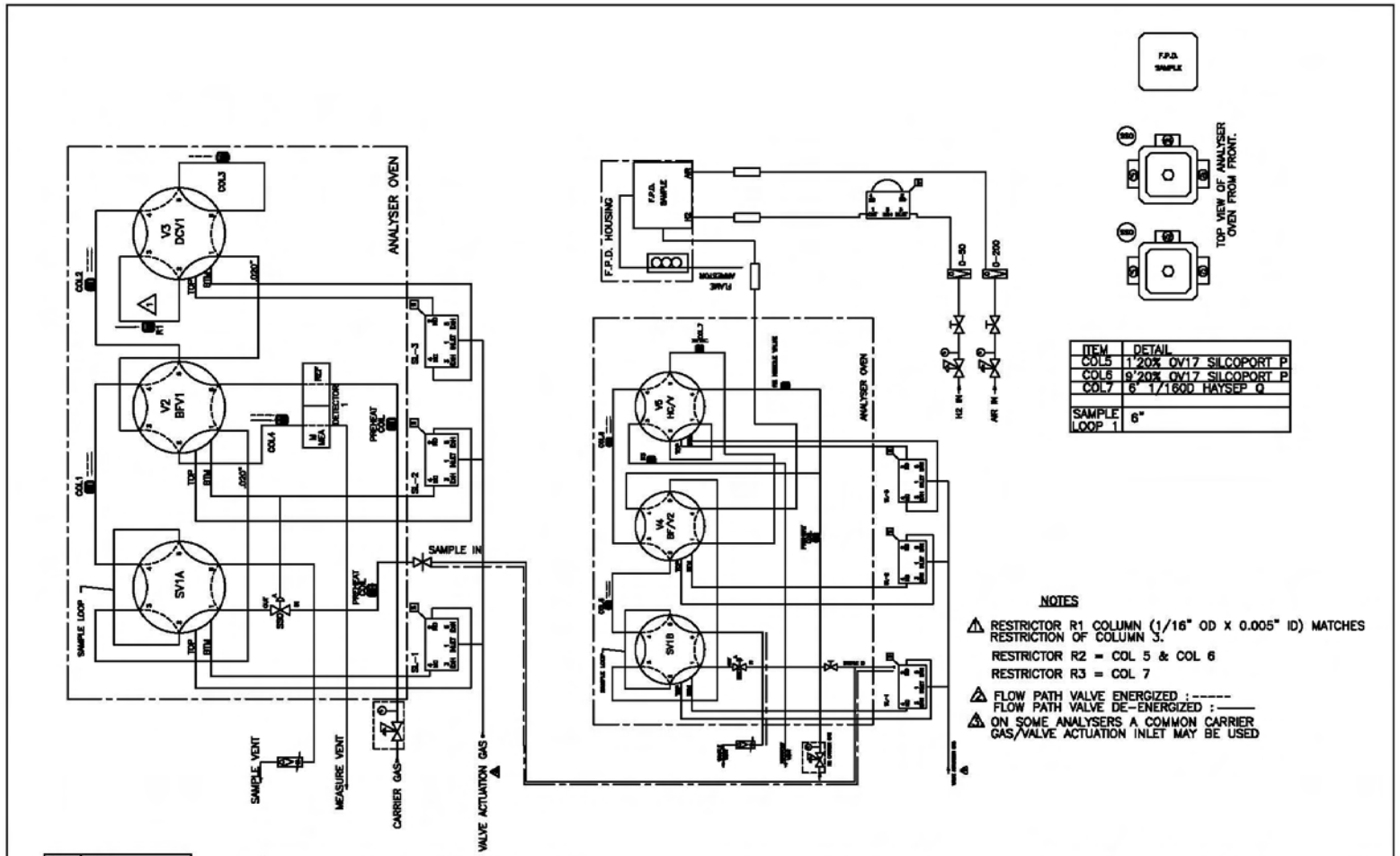
EMERSON. PROCESS MANAGEMENT

TITLE: FLOW DIAGRAM MODEL 500 FPD C6+/ SULPHUR

DRN	CTS	DATE	09/07/08
CHKD	CTS	DATE	09/07/08
APPD	NH	DATE	09/07/08

DWG NO. DUK7233/050/1 REV 1

SCALE NTS P/N SEE ORDER SHT 1 OF 1



ITEM	DETAIL
COL5	1'20% OV17 SILCOPORT P
COL6	9'20% OV17 SILCOPORT P
COL7	6' 1/160D HAYSEP Q
SAMPLE LOOP 1	6"

NOTES

1. RESTRICTOR R1 COLUMN (1/16" OD X 0.005" ID) MATCHES RESTRICTION OF COLUMN 3.
   RESTRICTOR R2 = COL 5 & COL 6
   RESTRICTOR R3 = COL 7
2. FLOW PATH VALVE ENERGIZED :------
   FLOW PATH VALVE DE-ENERGIZED :——
3. ON SOME ANALYSERS A COMMON CARRIER GAS/VALVE ACTUATION INLET MAY BE USED

ITEM	DETAIL
COL1	12' opn stc
COL2	7' 20% sf-96 c/sf
COL3	7' Hayesp N silcoport p
COL4	6'5% DW-200m silcoport p
SAMPLE LOOP	6"

FORMERLY DUK3253/360/1

SI METRIC

THIRD ANGLE PROJECTION

MATERIAL: BOM ORDER

FINISH:

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
0	02/09/08	NH	RELEASED	GM	NH

DRG SCALE - A1

DIMENSIONS IN INCHES

REF -

BREAK ALL SHARP CORNERS TO .002-.005 RADIUS AND REMOVE ALL BURRS

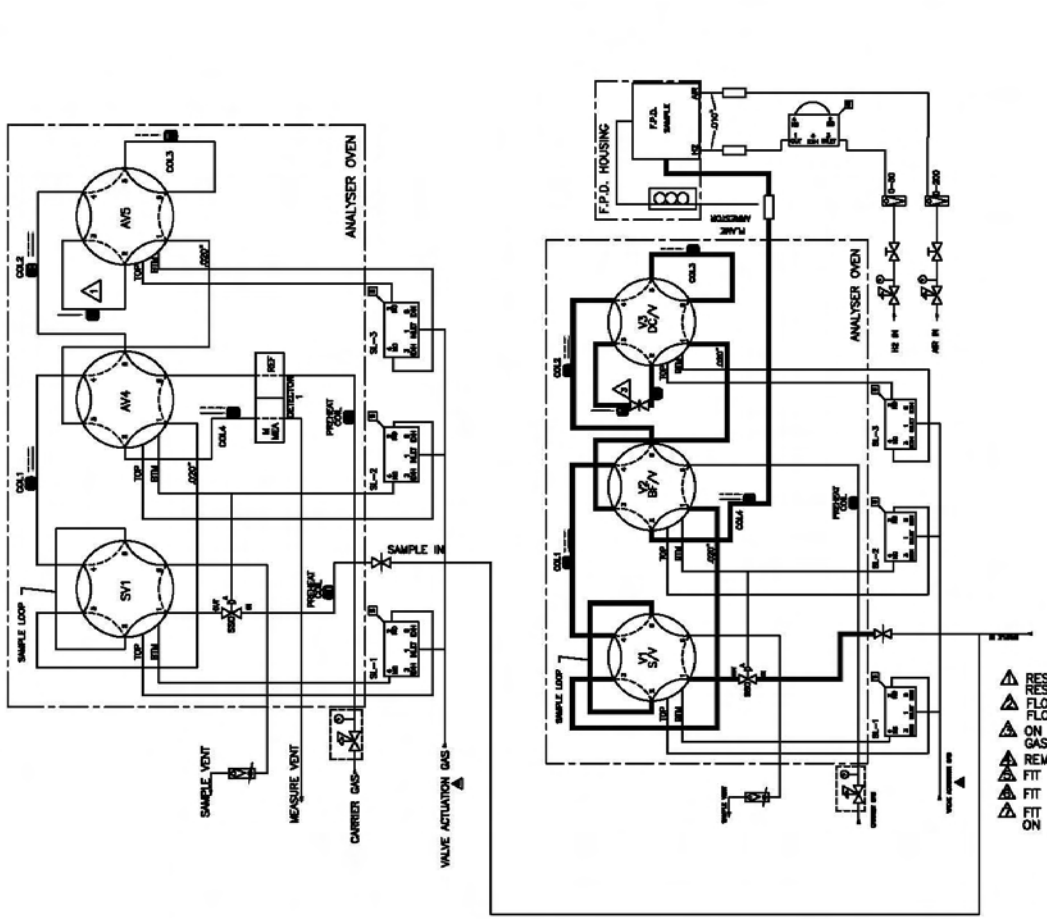
EMERSON PROCESS MANAGEMENT

TITLE: FLOW DIAGRAM MODEL 500 FPD C6+/ MERCAPTANS +

DRN	NH	DATE	02/09/08
CHKD	GM	DATE	02/09/08
APPR	NH	DATE	02/09/08

DWG NO. DUK7233/051/1 REV 0

SCALE NTS P/N SEE ORDER SHT 1 OF 1



NOTES

1. RESTRICTOR COLUMN (1/16" OD X 0.005" ID) MATCHES RESTRICTION OF COLUMN 3.
2. FLOW PATH VALVE ENERGIZED : ----- FLOW PATH VALVE DE-ENERGIZED : ——
3. ON SOME ANALYSERS A COMMON CARRIER GAS/VALVE ACTUATION INLET MAY BE USED
4. REMOVE WIRES 401&402 ON TB4 1&2 ON DET 2 GC
5. FIT WIRE FROM TB4-1 TO J8 PIN 3 ON 2350A CONTROLLER
6. FIT WIRE FROM TB4-2 TO J8 PIN 5 ON 2350A CONTROLLER
7. FIT WIRE FROM J8 PIN 4 TO PIN 6 TO PIN 3 OF J7 ON 2350 CONTROLLER

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
0	23/11/05	NH	RELEASED	GM	NH

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BIRS ORDER
FINISH:
BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

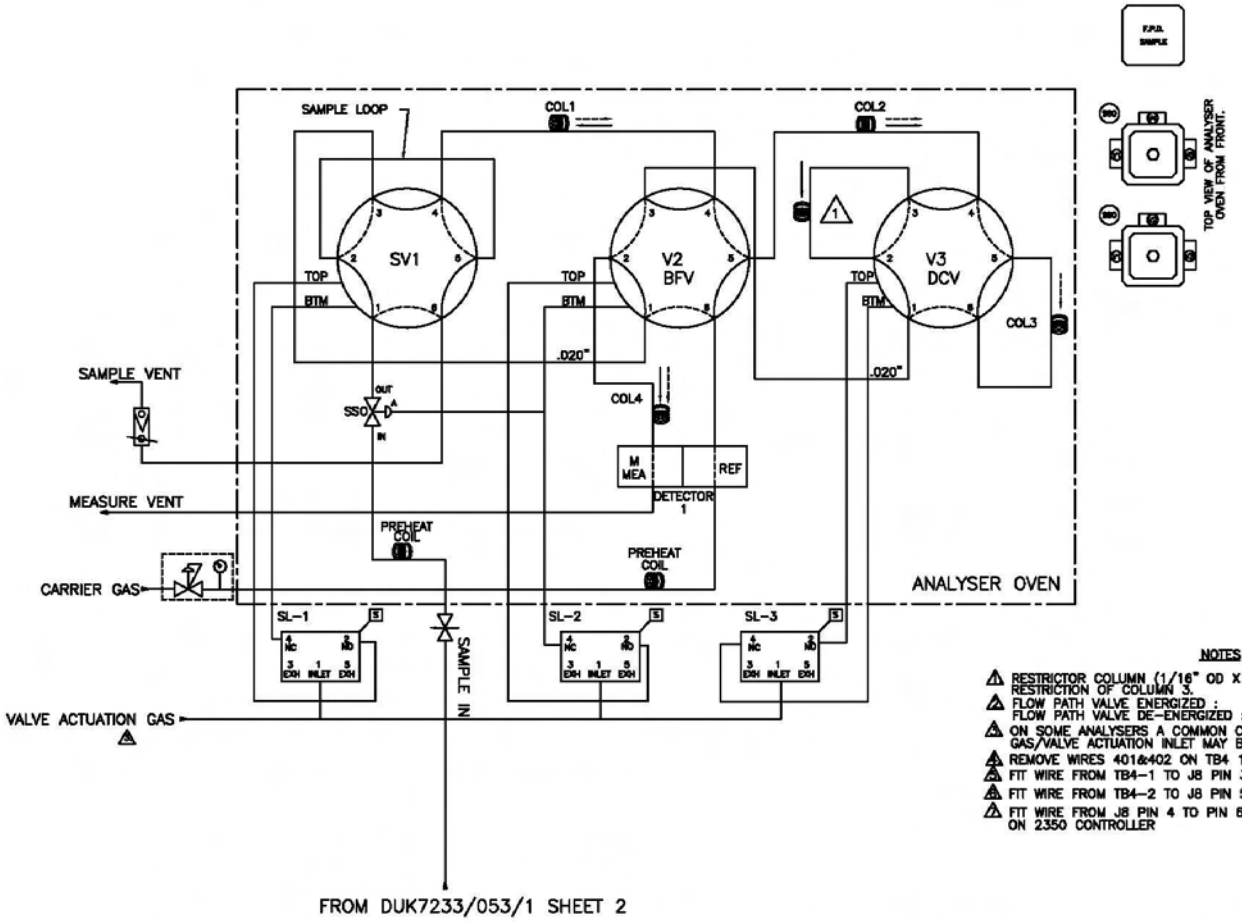
DRG SCALE - NL
DIMENSIONS IN INCHES
REF -

EMERSON PROCESS MANAGEMENT

TITLE: FLOW DIAGRAM MODEL 500 FPD C6+/ SULPHUR

DRN	NH	DATE	09/09/08
CHKD	GM	DATE	09/09/08
APPD	NH	DATE	09/09/08

DWG NO. DUK7233/052/1 REV 0
SCALE NTS PVN SEE ORDER SHT 1 OF 1



FROM DUK7233/053/1 SHEET 2

NOTES

1. RESTRICTOR COLUMN (1/16" OD X 0.005" ID) MATCHES RESTRICTION OF COLUMN 3.
2. FLOW PATH VALVE ENERGIZED : ----- FLOW PATH VALVE DE-ENERGIZED : ——
3. ON SOME ANALYSERS A COMMON CARRIER GAS/VALVE ACTUATION INLET MAY BE USED
4. REMOVE WIRES 401&402 ON TB4 1&2 ON DET 2 GC
5. FIT WIRE FROM TB4-1 TO J8 PIN 3 ON 2350A CONTROLLER
6. FIT WIRE FROM TB4-2 TO J8 PIN 5 ON 2350A CONTROLLER
7. FIT WIRE FROM J8 PIN 4 TO PIN 6 TO PIN 3 OF J7 ON 2350 CONTROLLER

SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: BOS ORDER						
FINISH:						
	0	23/02/09	NH	RELEASED	GM	NH
	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

ERDS SCALE - NL
DIMENSIONS IN INCHES
REF -

BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

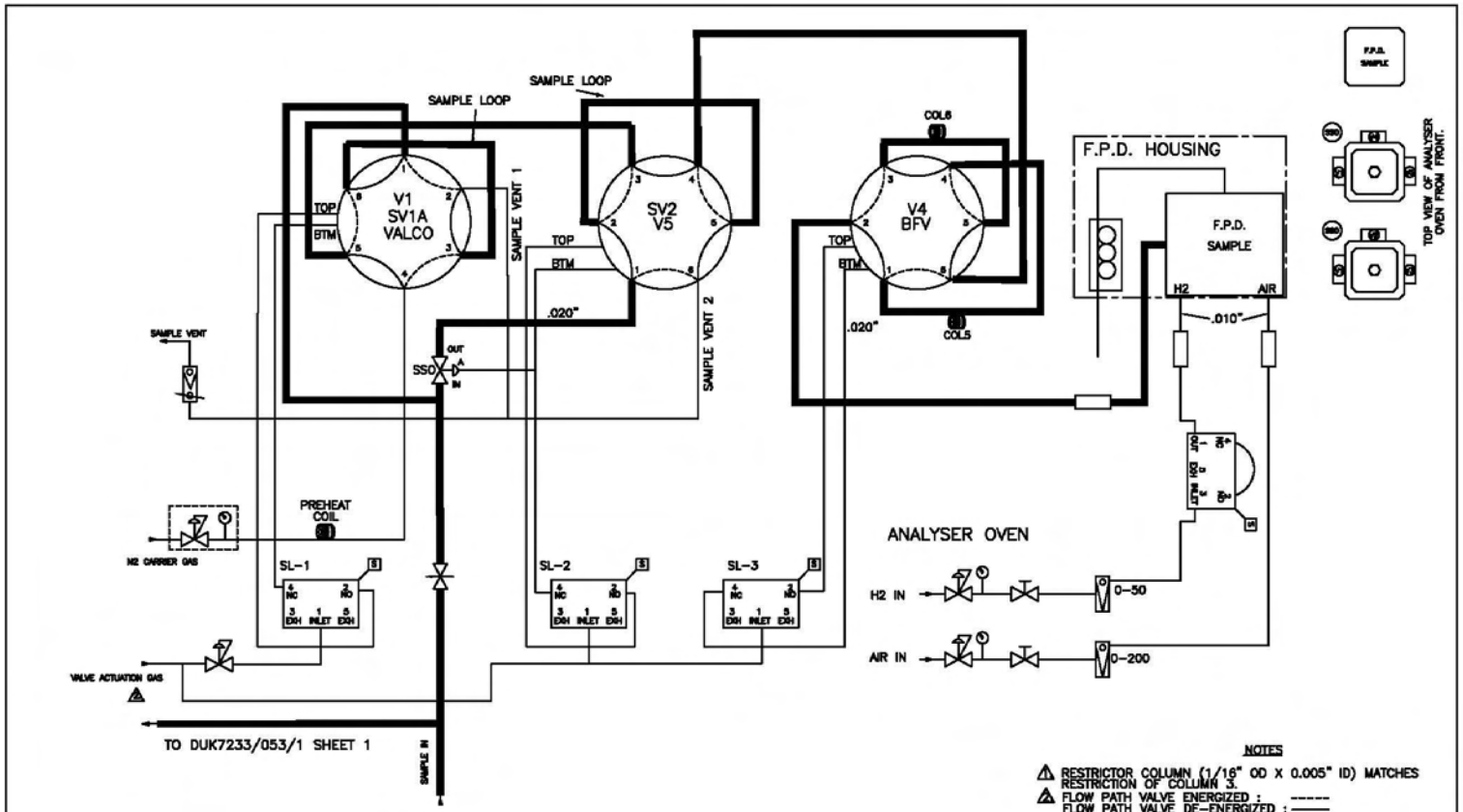
EMERSON. PROCESS MANAGEMENT

TITLE: FLOW DIAGRAM
MODEL 500 FPD
C6+/ SULPHUR + HIGH C3 & C4
VALCO 6 PORT INJECTION VALVE

DRN	NH	DATE	23/02/09
CHKD	GM	DATE	23/02/09
APPD	NH	DATE	23/02/09

DWG NO. DUK7233/053/1 REV 0

SCALE NTS P/N SEE ORDER SHT 1 OF 2



NOTES

1. RESTRICTOR COLUMN (1/16" OD X 0.005" ID) MATCHES RESTRICTION OF COLUMN 3.
2. FLOW PATH VALVE ENERGIZED : ------
   FLOW PATH VALVE DE-ENERGIZED : ——
3. ON SOME ANALYSERS A COMMON CARRIER GAS/VALVE ACTUATION INLET MAY BE USED
4. REMOVE WIRES 401&402 ON TB4 1&2 ON DET 2 GC
5. FIT WIRE FROM TB4-1 TO J8 PIN 3 ON 2350A CONTROLLER
6. FIT WIRE FROM TB4-2 TO J8 PIN 5 ON 2350A CONTROLLER
7. FIT WIRE FROM J8 PIN 4 TO PIN 6 TO PIN 3 OF J7 ON 2350 CONTROLLER

0	23/02/09	NH	RELEASED	GM	NH
REV	DATE	DRN	DESCRIPTION	CHKD	APPD

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BOS ORDER
FINISH:
BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

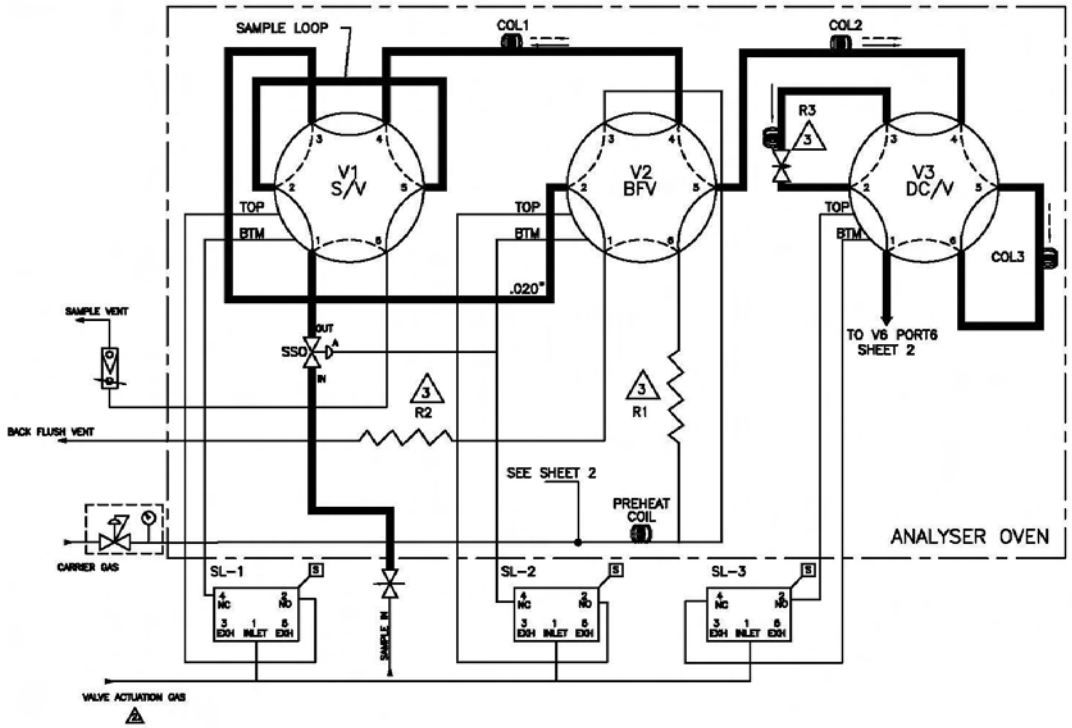
DRG SCALE - NL
DIMENSIONS IN INCHES
REF -

EMERSON PROCESS MANAGEMENT

TITLE
FLOW DIAGRAM
MODEL 500 FPD
C6+/ SULPHUR + HIGH C3 & C4
VALCO 6 PORT INJECTION VALVE

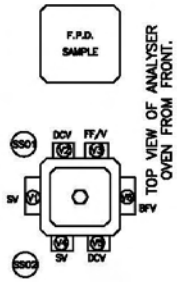
DRN	NH	DATE	23/02/09
CHKD	GM	DATE	23/02/09
APPD	NH	DATE	23/02/09

DWG NO. DUK7233/053/1 REV 0
SCALE NTS PVN SEE ORDER SHT 2 OF 2



NOTES

1. FLOW PATH VALVE ENERGIZED : - - - - -
   FLOW PATH VALVE DE-ENERGIZED : ———
   SILICA STEEL :–
2. ON SOME ANALYSERS A COMMON CARRIER/ACTUATION GAS INLET MAY BE USED
3. BALANCE FLOW RATES
   - R1= MATCHES RESTRICTION OF COL1
   - R2= MATCHES RESTRICTION OF COL2 + COL3
   - R3= MATCHES RESTRICTION OF COL3



TOP VIEW OF ANALYSER OVEN FROM FRONT.

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
0	25/02/09	NH	RELEASED	GM	NH

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: SEE ORDER
FINISH: N/A

DRG SCALE - A4
DIMENSIONS IN INCHES
REF -

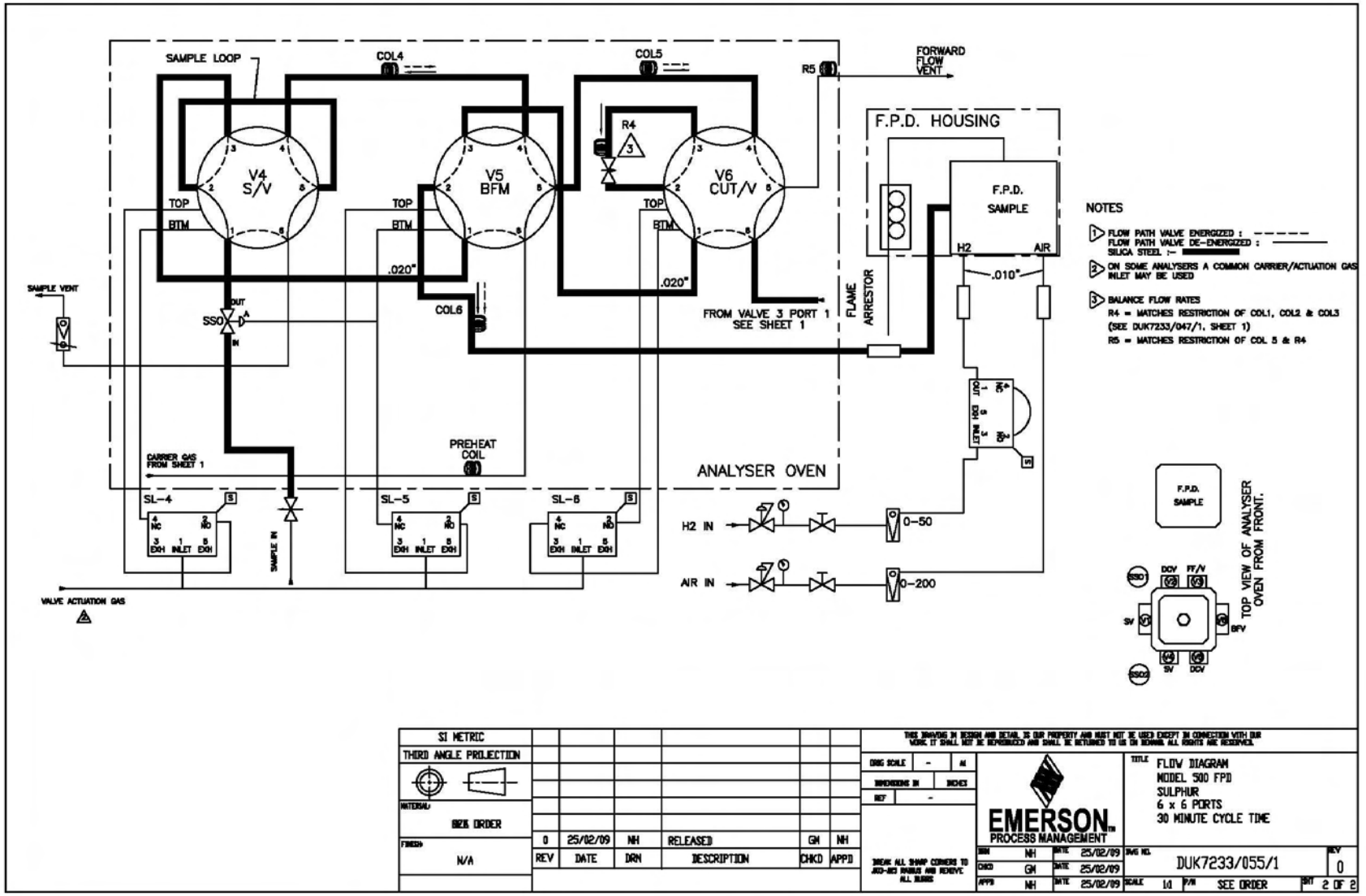
BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

EMERSON PROCESS MANAGEMENT

DRN	NH	DATE 25/02/09
CHKD	GM	DATE 25/02/09
APPD	NH	DATE 25/02/09

TITLE: FLOW DIAGRAM
MODEL 500 FPD
SULPHUR
6 x 6 PORTS
30 MINUTE CYCLE TIME

DWG NO. DUK7233/055/1 REV 0
SCALE 1:1 P/N SEE ORDER SHT 1 OF 2



SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: SEE ORDER						
FINISH: N/A	0	25/02/09	NH	RELEASED	GM	NH
	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

DRG SCALE - A4
DIMENSIONS IN INCHES
REF -

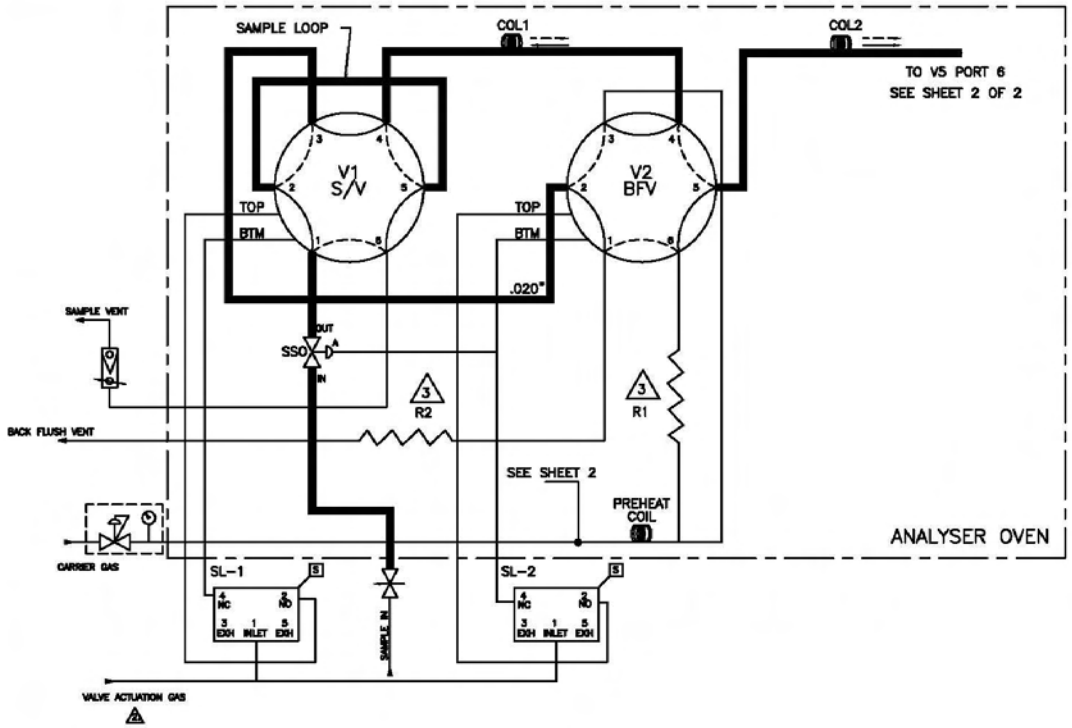
BREAK ALL SHARP CORNERS TO .003-.005 RADIUS AND REMOVE ALL BURRS

EMERSON PROCESS MANAGEMENT

DRN	NH	DATE	25/02/09
CHKD	GM	DATE	25/02/09
APPD	NH	DATE	25/02/09

TITLE: FLOW DIAGRAM
MODEL 500 FPD
SULPHUR
6 x 6 PORTS
30 MINUTE CYCLE TIME

DWG NO. DUK7233/055/1 REV 0
SCALE 1:1 P/N SEE ORDER SHT 2 OF 2

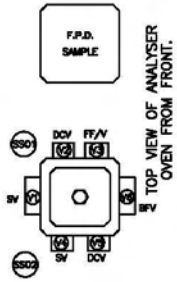


NOTES

1. FLOW PATH VALVE ENERGIZED : - - - - -
   FLOW PATH VALVE DE-ENERGIZED : ———
   SILICA STEEL :-
2. ON SOME ANALYSERS A COMMON CARRIER/ACTUATION GAS INLET MAY BE USED
3. BALANCE FLOW RATES

   R1= MATCHES RESTRICTION OF COL1

   R2= MATCHES RESTRICTION OF COL2 + COL3



TOP VIEW OF ANALYSER OVEN FROM FRONT.

0	21/04/09	NH	RELEASED		GM	NH
REV	DATE	DRN	DESCRIPTION		CHKD	APPD

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BER ORDER
FINISH: N/A
DRG SCALE: - A4
DIMENSIONS IN: INCHES
REF: -

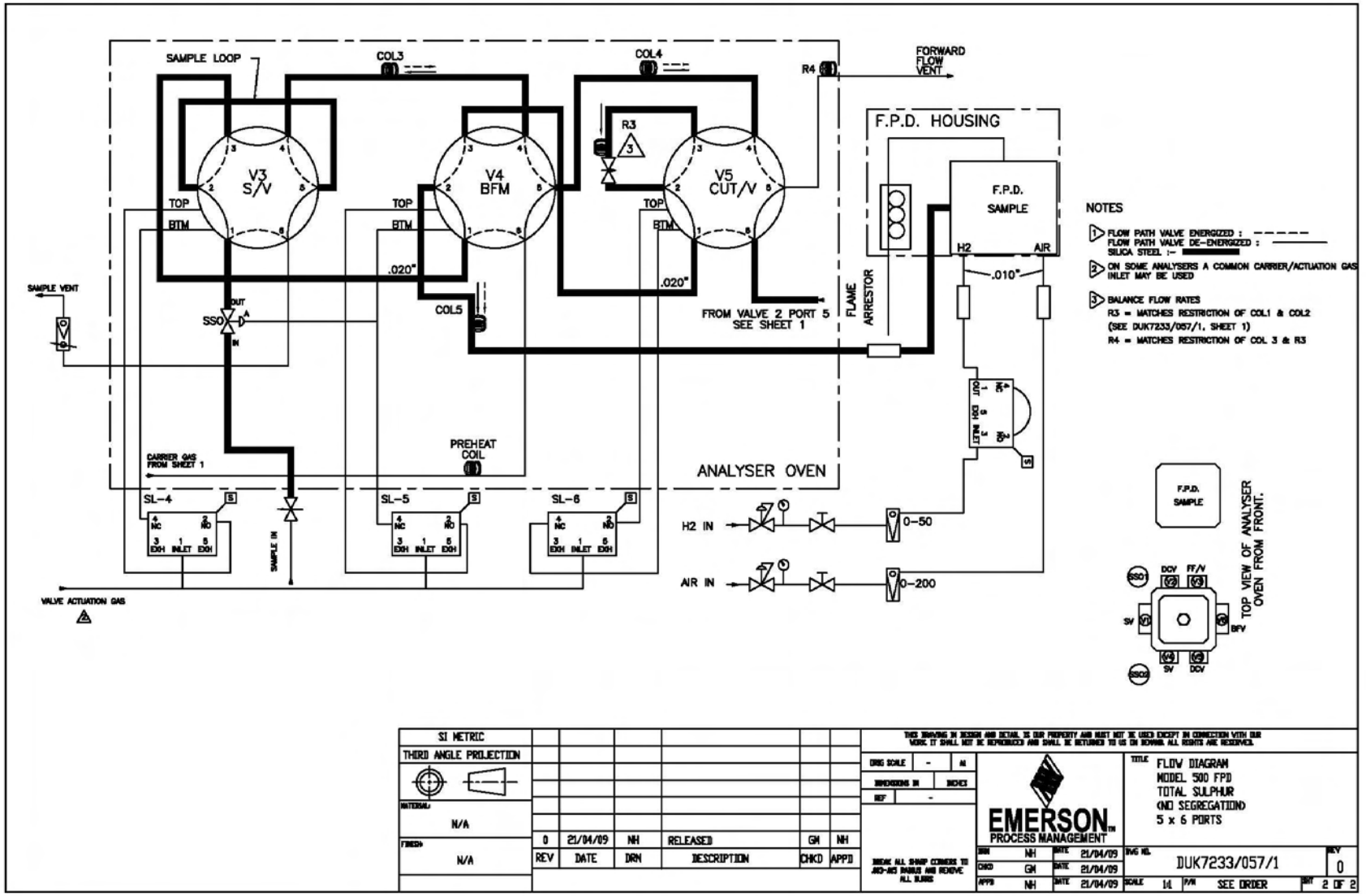
BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

EMERSON PROCESS MANAGEMENT

DRN	NH	DATE	21/04/09
CHKD	GM	DATE	21/04/09
APPD	NH	DATE	21/04/09

TITLE: FLOW DIAGRAM
MODEL 500 FPD
TOTAL SULPHUR (NO SEGREGATION)
5 x 6 PORTS : APP 68

DWG NO: DUK7233/057/1 REV: 0
SCALE: 1:1 P/N: SEE ORDER SHT: 1 OF 2



0	21/04/09	NH	RELEASED		GM	NH
REV	DATE	DRN	DESCRIPTION		CHKD	APPD

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: N/A
FINISH: N/A

BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

DRG SCALE - A4
DIMENSIONS IN INCHES
REF -

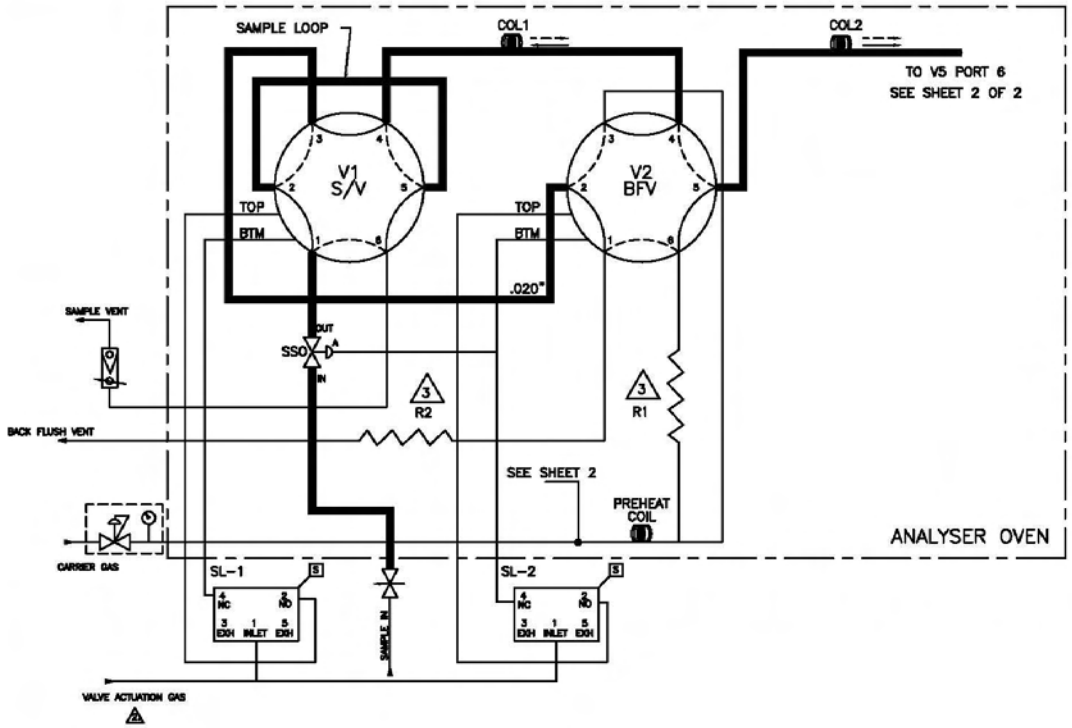
EMERSON PROCESS MANAGEMENT

DRN	NH	DATE	21/04/09
CHKD	GM	DATE	21/04/09
APPD	NH	DATE	21/04/09

TITLE: FLOW DIAGRAM MODEL 500 FPD TOTAL SULPHUR (NO SEGREGATION) 5 x 6 PORTS

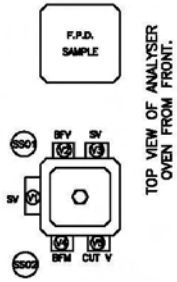
DWG NO. DUK7233/057/1 REV 0

SCALE 1:1 P/N SEE ORDER SHT 2 OF 2



NOTES

1. FLOW PATH VALVE ENERGIZED : ----- FLOW PATH VALVE DE-ENERGIZED : ——— SILICA STEEL :–
2. ON SOME ANALYSERS A COMMON CARRIER/ACTUATION GAS INLET MAY BE USED
3. BALANCE FLOW RATES
   R1= MATCHES RESTRICTION OF COL1
   R2= MATCHES RESTRICTION OF COL2 + COL3



TOP VIEW OF ANALYSER OVEN FROM FRONT.

0	28/09/09	NH	RELEASED	GM	NH
REV	DATE	DRN	DESCRIPTION	CHKD	APPD

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: N/A
FINISH: N/A

DRG SCALE - AS
DIMENSIONS IN INCHES
REF -

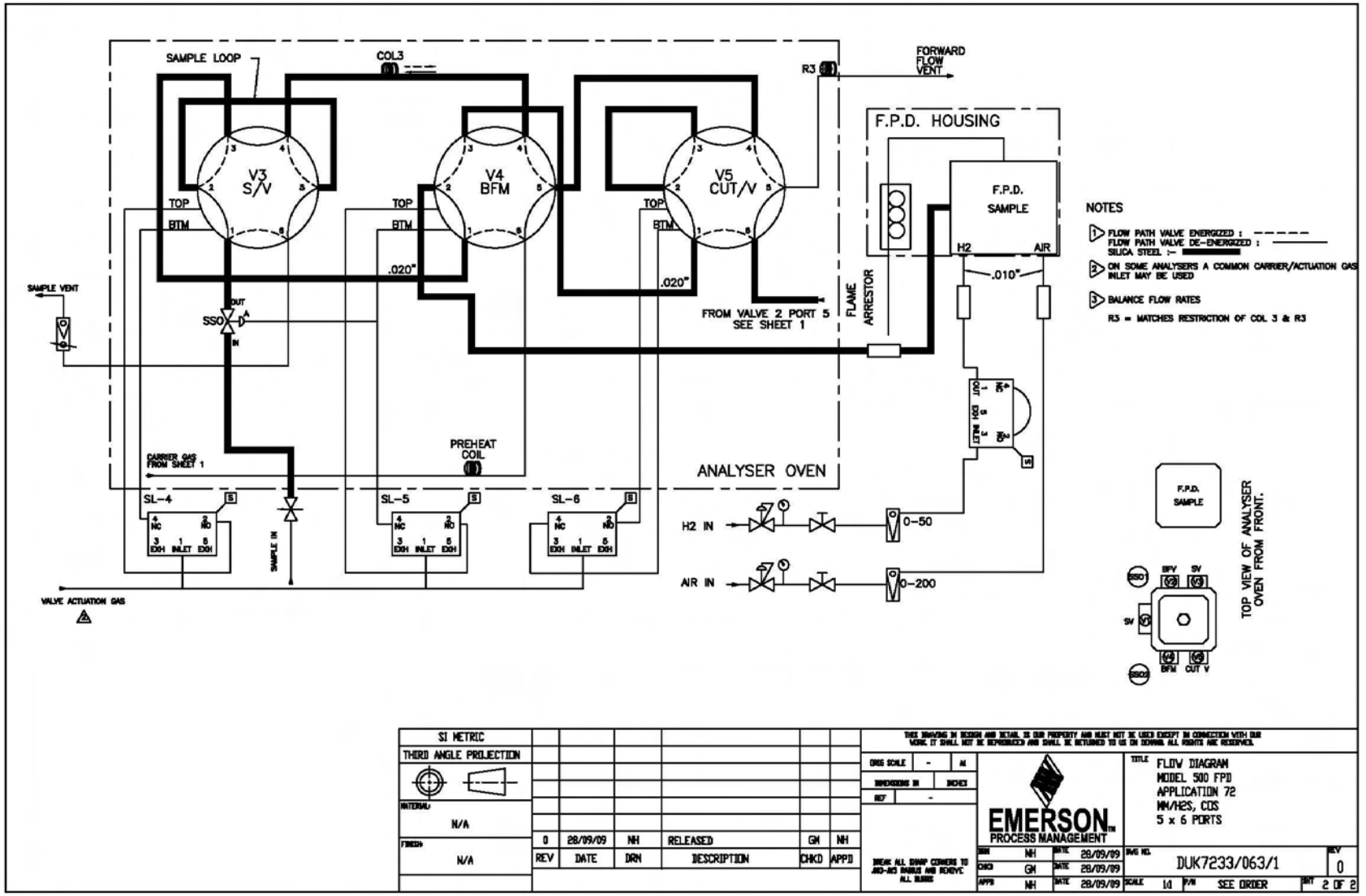
BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

EMERSON PROCESS MANAGEMENT

DRN	NH	DATE 28/09/09
CHKD	GM	DATE 28/09/09
APPD	NH	DATE 28/09/09

TITLE: FLOW DIAGRAM
MODEL 500 FPD
APPLICATION 72
NM/H2S, COS
5 x 6 PORTS

DWG NO. DUK7233/063/1 REV 0
SCALE 1:1 P/N SEE ORDER SHT 1 OF 2



REV	DATE	DRN	DESCRIPTION	CHKD	APPD
0	28/09/09	NH	RELEASED	GM	NH

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: N/A
FINISH: N/A

DRG SCALE - A4
DIMENSIONS IN INCHES
REF -

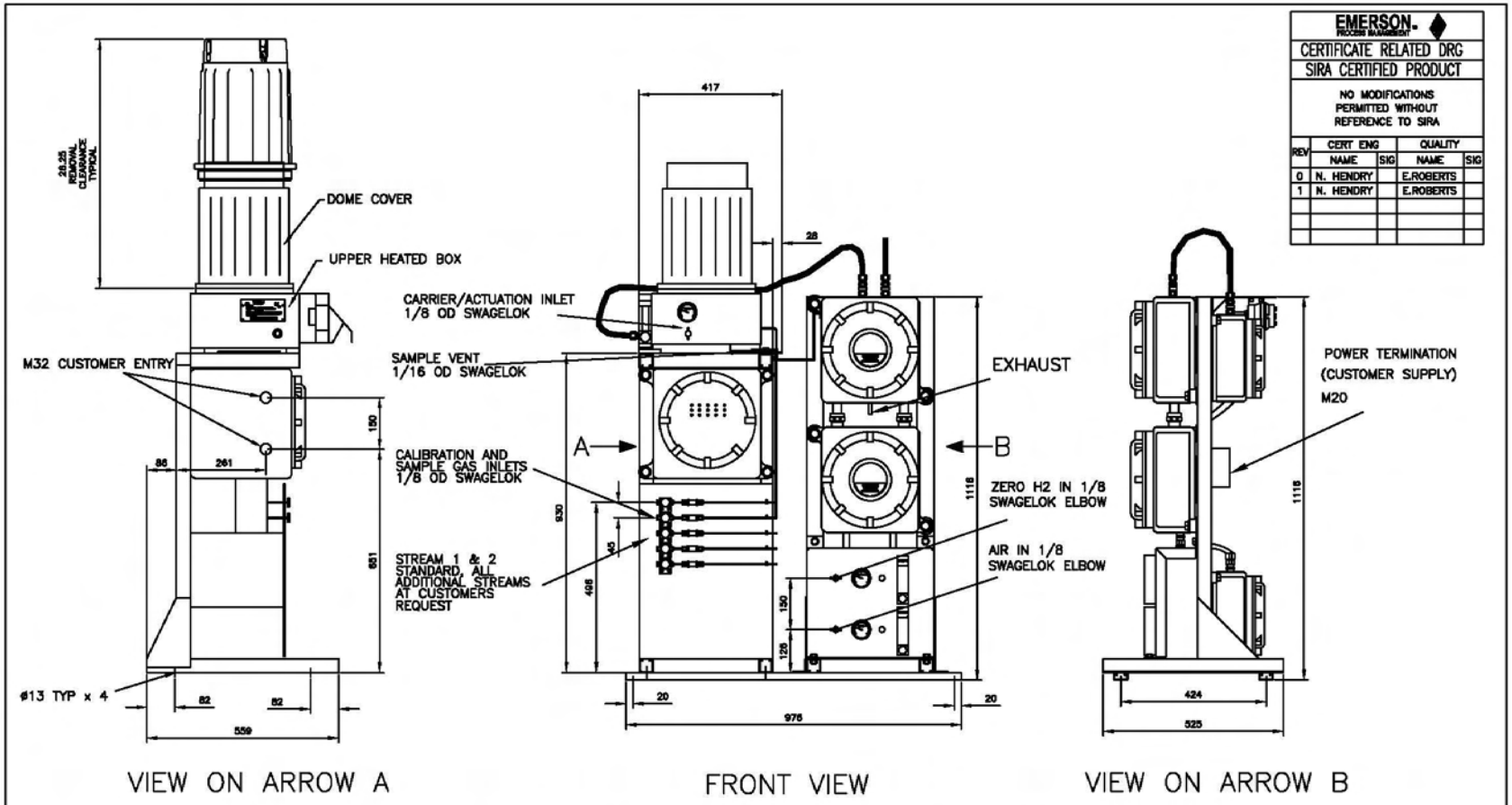
BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

EMERSON PROCESS MANAGEMENT

DRN	NH	DATE 28/09/09
CHKD	GM	DATE 28/09/09
APPD	NH	DATE 28/09/09

TITLE: FLOW DIAGRAM
MODEL 500 FPD
APPLICATION 72
NM/HES, CDS
5 x 6 PORTS

DWG NO. DUK7233/063/1 REV 0
SCALE 1:1 P/N SEE ORDER SHT 2 OF 2



VIEW ON ARROW A

FRONT VIEW

VIEW ON ARROW B

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	

1	13/06/07	CTS	ECN 2579/07	CTS	NH
0	28/11/06	CTS	RELEASED	CTS	DG
REV	DATE	DRN	DESCRIPTION	CHKD	APPD

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: SIZE ORDER
FINISH: N/A

GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
XXX ±.005
XXXX ±.0005
ANGULAR ±0° 30'
FINISH 250 RA MAX

BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

EMERSON PROCESS MANAGEMENT

DRN	CTS	DATE	28/11/06
CHKD	CTS	DATE	28/11/06
APPD	DG	DATE	28/11/06

TITLE: MODEL 700 FPD G/A

DWG NO. DUK7204/074/1 REV 1

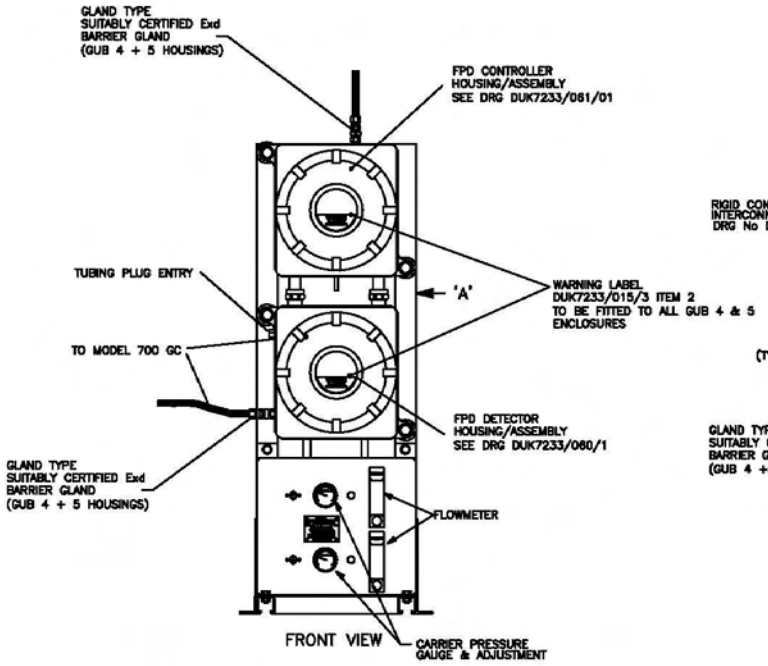
SCALE 1:1 P/N SEE ORDER SHT 1 OF 1

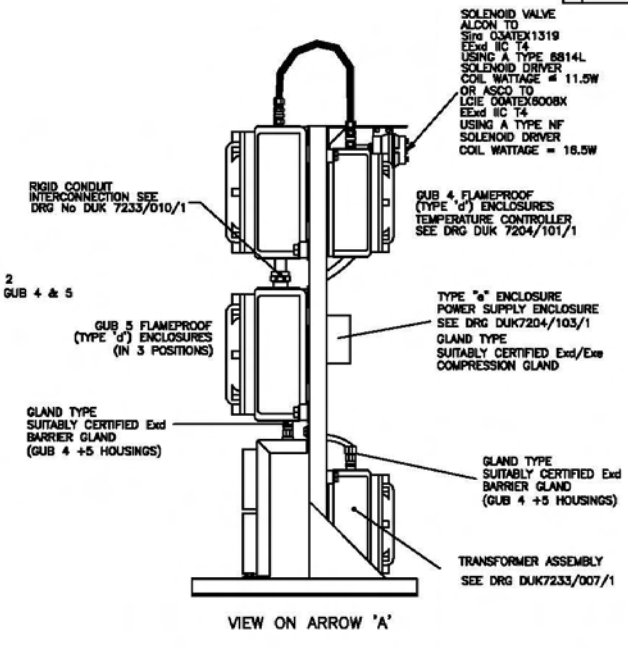
NOTES:
1. ALL METAL USED IN CONSTRUCTION TO HAVE A MAGNESIUM CONTENT OF LESS THAN 6%.
2. MAX AMBIENT TEMPERATURE 55°C.
3. MAX AMBIENT TEMPERATURE INSIDE WEATHERPROOF HOUSING 60°C.
4. EQUIPMENT MUST BE INSTALLED IN COMPLIANCE WITH EN60079-14
5. ALL FLAMEPROOF ENCLOSURES ARE INSTALLED IN COMPLIANCE WITH 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 2.5mm^2 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 PROCESS MANAGEMENT

CERTIFICATE SCHEDULE DRG
SIRA CERTIFIED PRODUCT
NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO SIRA

REV	CERT ENG NAME	CERT ENG SIG	QUALITY NAME	QUALITY SIG
0	N. HENDRY		E.ROBERTS	
1	N. HENDRY		E. ROBERTS	
2	N. HENDRY		E. ROBERTS	





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

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: SEE ORDER
FINISH: N/A

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

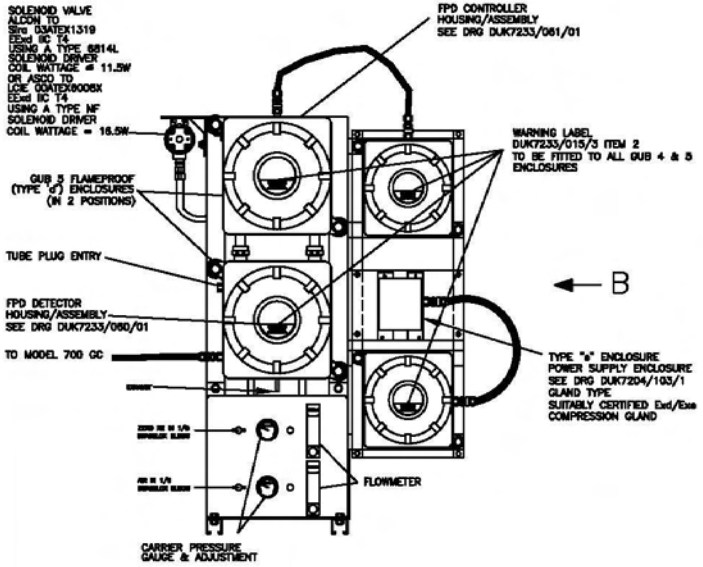
NOTES:
1. ALL METAL USED IN CONSTRUCTION TO HAVE A MAGNESIUM CONTENT OF LESS THAN 6%.
2. MAX AMBIENT TEMPERATURE 55°C.
3. MAX AMBIENT TEMPERATURE INSIDE WEATHERPROOF HOUSING 60°C.
4. EQUIPMENT MUST BE INSTALLED IN COMPLIANCE WITH EN60079-14
5. ALL FLAMEPROOF ENCLOSURES ARE INSTALLED IN COMPLIANCE WITH 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 2.5mm^2 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. PROCESS MANAGEMENT

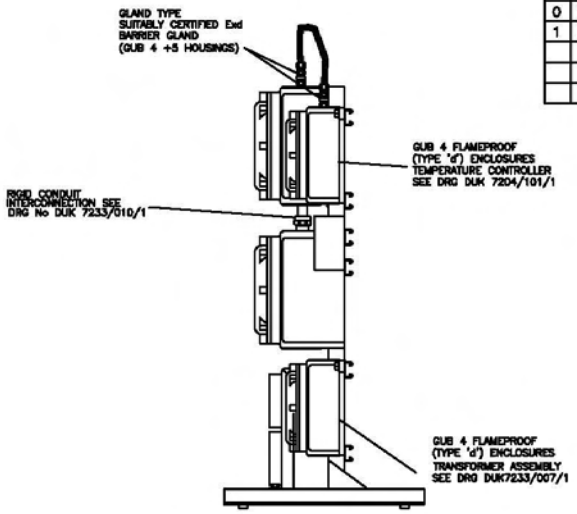
CERTIFICATE SCHEDULE DRG
SIRA CERTIFIED PRODUCT

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	



FRONT VIEW



VIEW ON ARROW B

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
1	26/05/09	NH	ECN 2549/09	GM	NH
0	20/01/09	NH	RELEASED	GM	NH

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: SEE ORDER
FINISH: N/A

GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES

BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

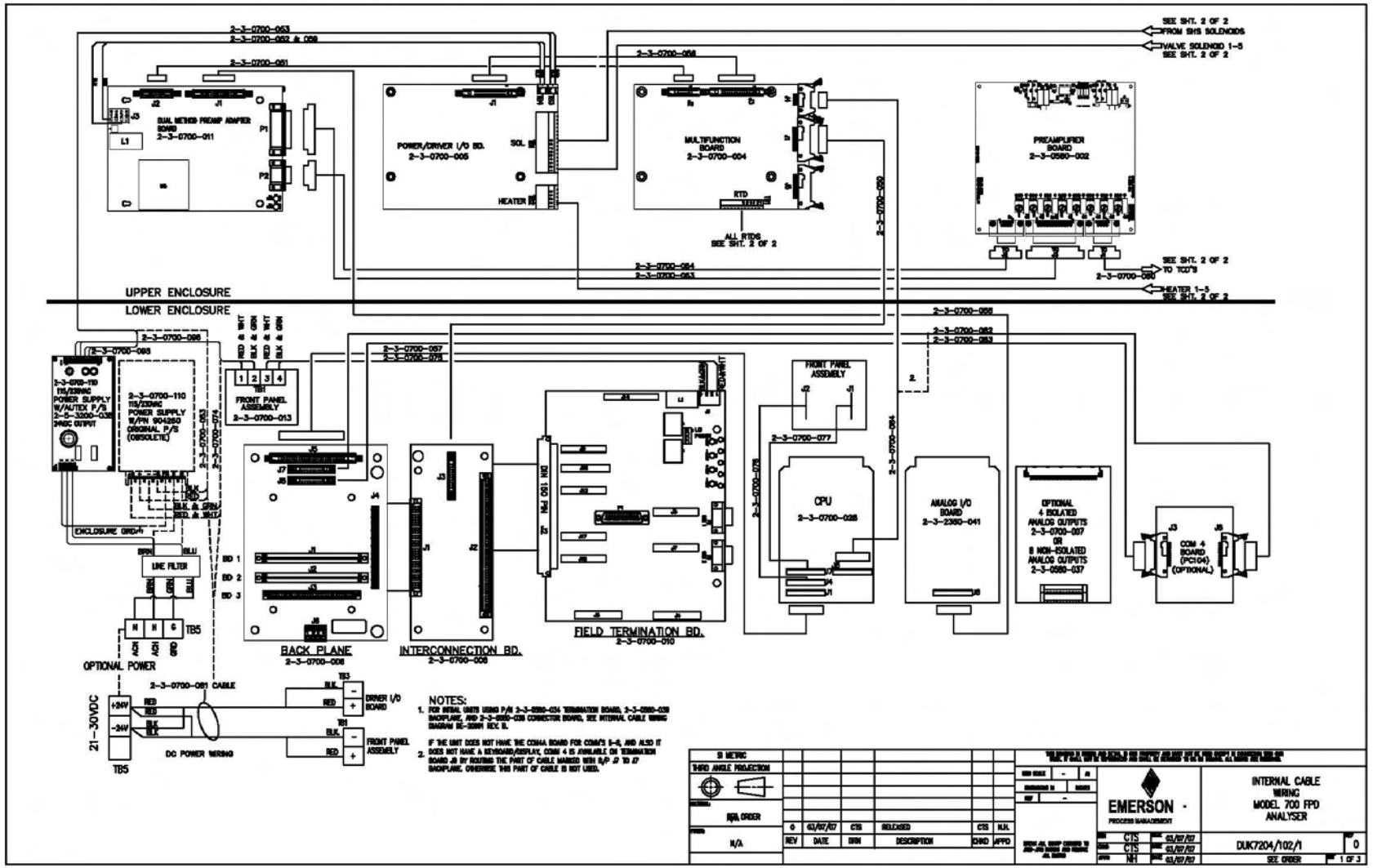
EMERSON PROCESS MANAGEMENT

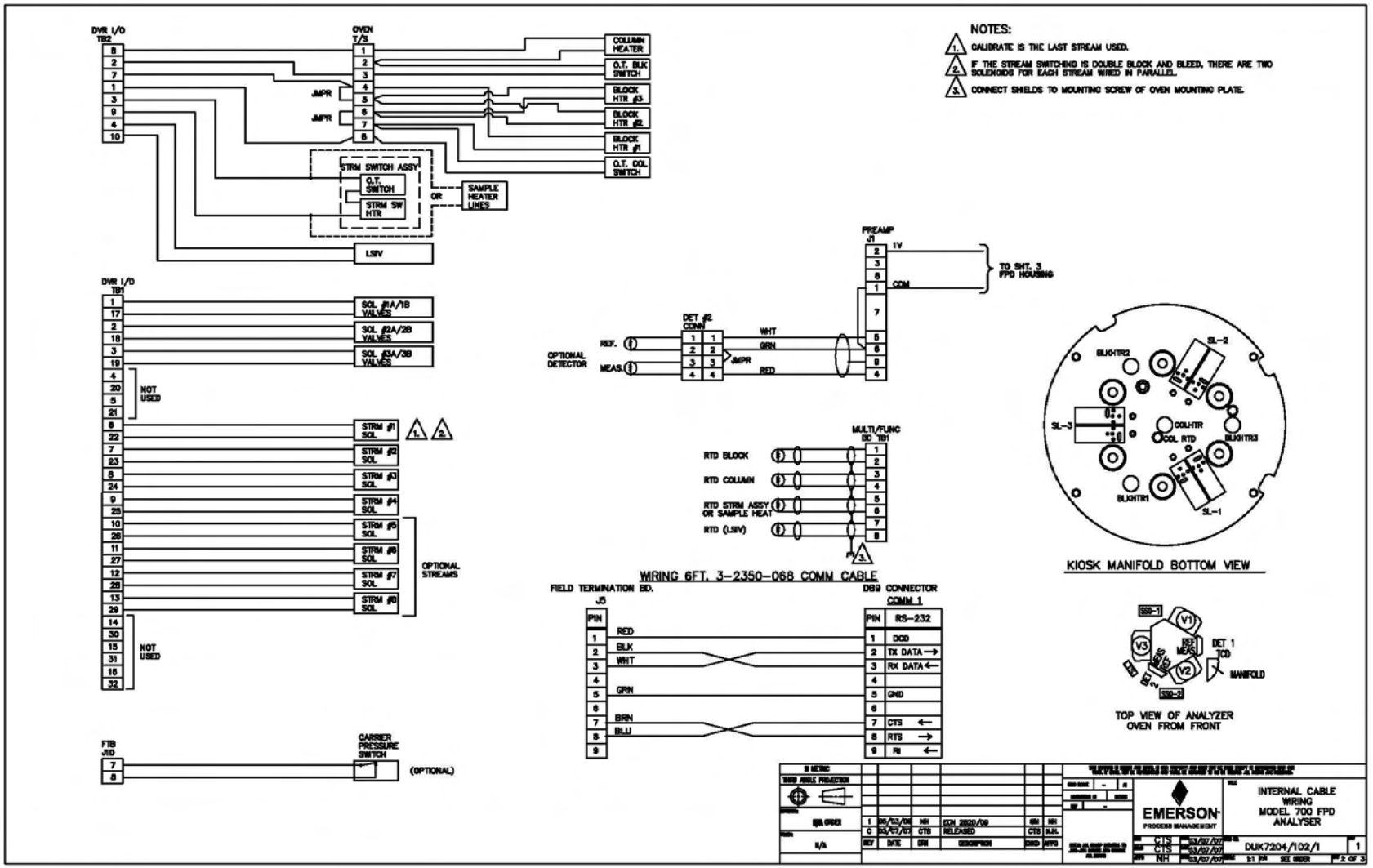
DRN	DATE 20/01/09	
CHKD	DATE 20/01/09	
APPD	DATE 20/01/09	

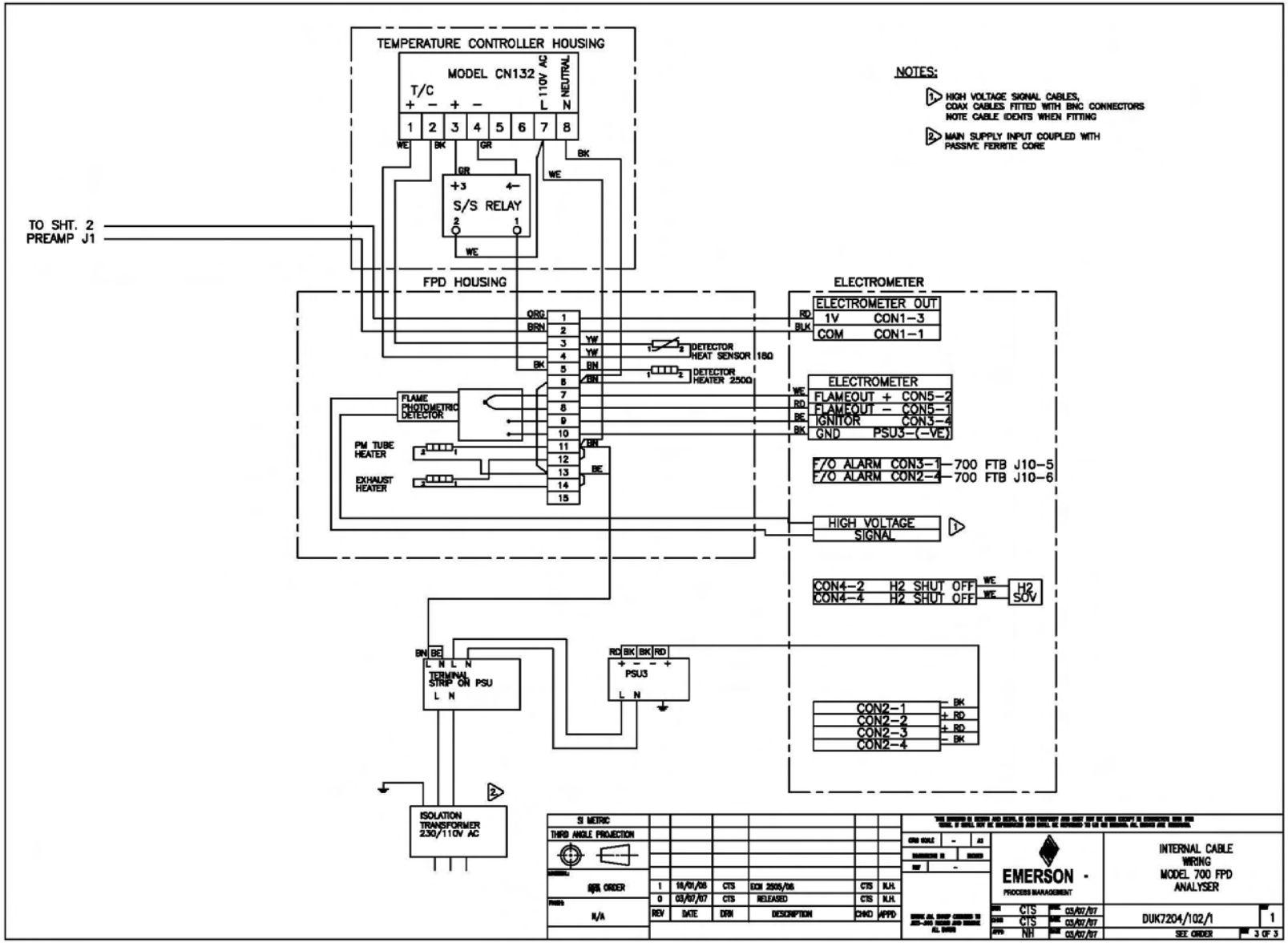
TITLE: GA : FPD MODULE FRONT ACCESS

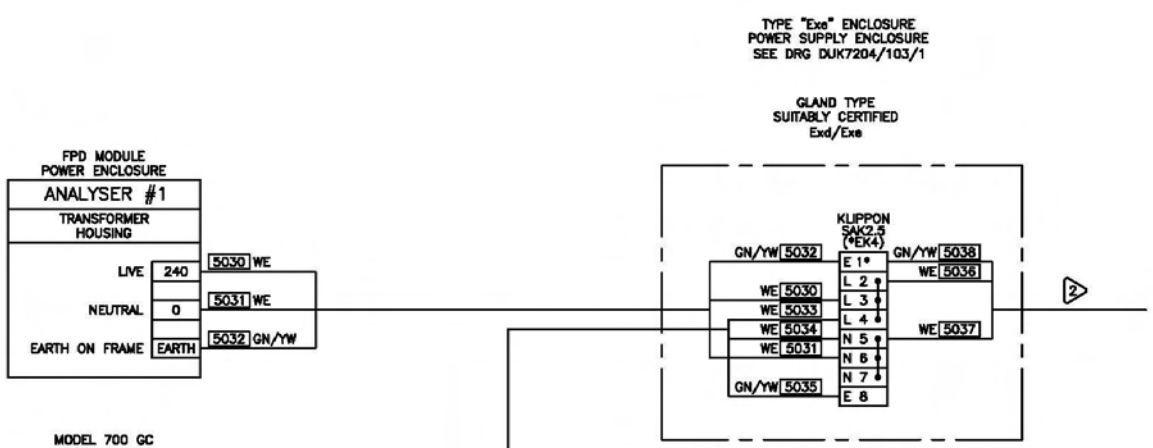
DWG NO: DUK7204/156/1 REV: 1

SCALE: 1:1 P/N: SEE ORDER SHT: 1 OF 1


2-3-0700-053
2-3-0700-052 & 059
2-3-0700-051
SEE SHT. 2 OF 2
FROM SHS SOLENOIDS
VALVE SOLENOID 1-5
SEE SHT. 2 OF 2
DUAL METHOD PREAMP ADAPTER BOARD
2-3-0700-011
POWER/DRIVER I/O BD.
2-3-0700-005
SOL.
HEATER
2-3-0700-056
MULTIFUNCTION BOARD
2-3-0700-004
RTD
ALL RTDS
SEE SHT. 2 OF 2
2-3-0700-059
PREAMPLIFIER BOARD
2-3-0580-002
SEE SHT. 2 OF 2
TO TCD'S
2-3-0700-060
HEATER 1-5
SEE SHT. 2 OF 2
2-3-0700-064
2-3-0700-063
UPPER ENCLOSURE
LOWER ENCLOSURE
2-3-0700-096
2-3-0700-093
2-3-0700-110
115/230VAC
POWER SUPPLY
W/PN 9043050
ORIGINAL P/S
(OBSOLETE)
2-3-0700-053
2-3-0700-074
RED & WHT
BLK & GRN
RED & WHT
BLK & GRN
TB1
1 2 3 4
FRONT PANEL ASSEMBLY
2-3-0700-013
2-3-0700-057
2-3-0700-075
2-3-0700-055
2-3-0700-062
2-3-0700-063
FRONT PANEL ASSEMBLY
2-3-0700-077
CPU
2-3-0700-026
ANALOG I/O BOARD
2-3-2360-041
OPTIONAL
4 ISOLATED
ANALOG OUTPUTS
2-3-0700-037
OR
8 NON-ISOLATED
ANALOG OUTPUTS
2-3-0580-037
COM 4
BOARD
(PC104)
(OPTIONAL)
2-3-0700-078
2-3-0700-054
ENCLOSURE GRD
BRN
BLU
LINE FILTER
BRN
GRN
BLU
N
H
G
TB5
AUX
AUX
GRD
OPTIONAL POWER
BD 1
BD 2
BD 3
BACK PLANE
2-3-0700-008
INTERCONNECTION BD.
2-3-0700-009
FIELD TERMINATION BD.
2-3-0700-010
2-3-0700-061 CABLE
+24V
-24V
21-30VDC
RED
BLK
TB5
DC POWER WIRING
TB3
BLK.
RED
DRIVER I/O BOARD
TB1
BLK.
RED
FRONT PANEL ASSEMBLY
NOTES:
1. FOR METAL UNITS USING P/N 2-3-0580-034 TERMINATION BOARD, 2-3-0580-039 BACKPLANE, AND 2-3-0580-038 CONNECTOR BOARD, SEE INTERNAL CABLE WIRING DIAGRAM DC-2001 REV. B.
2. IF THE UNIT DOES NOT HAVE THE COMM4 BOARD FOR COMM'S 5-8, AND ALSO IT DOES NOT HAVE A KEYBOARD/DISPLAY, COMM 4 IS AVAILABLE ON TERMINATION BOARD J8 BY ROUTING THE PART OF CABLE MARKED WITH S/P J7 TO J7 BACKPLANE. OTHERWISE THIS PART OF CABLE IS NOT USED.
SI METRIC
THIRD ANGLE PROJECTION
N/A
0 02/07/07 CTS RELEASED CTS N.H.
REV DATE DRN DESCRIPTION CHKD APPD
EMERSON
PROCESS MANAGEMENT
INTERNAL CABLE WIRING
MODEL 700 FPD ANALYSER
DUK7204/102/1
0
SEE ORDER
1 OF 3


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.
DVR I/O TB2
OVEN T/S
COLUMN HEATER
O.T. BLK SWITCH
BLOCK HTR #3
BLOCK HTR #2
BLOCK HTR #1
O.T. COL SWITCH
JMPR
JMPR
STRM SWITCH ASSY
O.T. SWITCH
STRM SW HTR
OR
SAMPLE HEATER LINES
LSIV
DVR I/O TB1
SOL #1A/1B VALVES
SOL #2A/2B VALVES
SOL #3A/3B VALVES
NOT USED
STRM #1 SOL
STRM #2 SOL
STRM #3 SOL
STRM #4 SOL
STRM #5 SOL
STRM #6 SOL
STRM #7 SOL
STRM #8 SOL
OPTIONAL STREAMS
NOT USED
FTB J10
CARRIER PRESSURE SWITCH
(OPTIONAL)
PREAMP J1
1V
COM
TO SHT. 3 FPD HOUSING
DET #2 CONN
OPTIONAL DETECTOR
REF.
MEAS.
JMPR
WHT
GRN
RTD
MULTI/FUNC BD TB1
RTD BLOCK
RTD COLUMN
RTD STRM ASSY OR SAMPLE HEAT
RTD (LSIV)
WIRING 6FT. 3-2350-068 COMM CABLE
FIELD TERMINATION BD. J5
DB9 CONNECTOR COMM 1
PIN
RS-232
RED
BLK
WHT
GRN
BRN
BLU
DCD
TX DATA
RX DATA
GND
CTS
RTS
RI
KIOSK MANIFOLD BOTTOM VIEW
SL-1
SL-2
SL-3
BLKHTR1
BLKHTR2
BLKHTR3
COLHTR
COL RTD
TOP VIEW OF ANALYZER OVEN FROM FRONT
V1
V2
V3
REF
MEAS
DET 1
MANIFOLD
EMERSON
PROCESS MANAGEMENT
INTERNAL CABLE WIRING
MODEL 700 FPD ANALYSER
DUK7204/102/1
CTS
NH


TEMPERATURE CONTROLLER HOUSING
MODEL CN132
T/C
110V AC
NEUTRAL
L N
1 2 3 4 5 6 7 8
WE BK GR BK
GR
+3 4-
S/S RELAY
2 1
WE
WE
TO SHT. 2
PREAMP J1
FPD HOUSING
ELECTROMETER
ORG 1
BRN 2
3 YW
4 YW
BK 5 BN
6 BR
7
8
9
10
11 BR
12
13 BE
14
15
DETECTOR HEAT SENSOR 18Ω
DETECTOR HEATER 250Ω
FLAME PHOTOMETRIC DETECTOR
PM TUBE HEATER
EXHAUST HEATER
ELECTROMETER OUT
RD 1V CON1-3
BLK COM CON1-1
ELECTROMETER
WE FLAMEOUT + CON5-2
RD FLAMEOUT - CON5-1
BE IGNITOR CON3-4
BK 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
WE
WE
H2 SOV
BN BE
L N L N
TERMINAL STRIP ON PSU
L N
RD BK BK RD
PSU3
L N
CON2-1 - BK
CON2-2 + RD
CON2-3 + RD
CON2-4 - BK
ISOLATION TRANSFORMER 230/110V AC
NOTES:
1. HIGH VOLTAGE SIGNAL CABLES, COAX CABLES FITTED WITH BNC CONNECTORS NOTE CABLE IDENTS WHEN FITTING
2. MAIN SUPPLY INPUT COUPLED WITH PASSIVE FERRITE CORE
SI METRIC
THIRD ANGLE PROJECTION
QUOTATION
QUOTATION ORDER
FINISH
N/A
REV DATE DRN DESCRIPTION CHKD APPD
1 18/01/08 CTS ECN 2505/06 CTS N.H.
0 03/07/07 CTS RELEASED CTS N.H.
EMERSON
PROCESS MANAGEMENT
INTERNAL CABLE WIRING MODEL 700 FPD ANALYSER
DRN CTS 03/07/07
CHKD CTS 03/07/07
APPD NH 03/07/07
DUK7204/102/1
1
SEE ORDER
3 OF 3



EMERSON. PROCESS MANAGEMENT

CERTIFICATE RELATED DRG

SIRA CERTIFIED PRODUCT

NO MODIFICATIONS PERMITTED WITHOUT REFERENCE TO CERTIFICATION ENGINEER

REV	CERT ENG		QUALITY	
	NAME	SIG	NAME	SIG
0	N. HENDRY		E.ROBERTS	

NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL CABLE IS BS 6883
2. CABLE SUPPLIED & INSTALLED BY OTHERS

COLOUR ABBREVIATIONS			
BK	BLACK	RD	RED
BE	BLUE	SE	SLATE
BN	BROWN	VT	VIOLET
GN	GREEN	WE	WHITE
GY	GREY	YW	YELLOW
OE	ORANGE	PK	PINK
L/BE	LIGHT BLUE	GN/YW	GREEN YELLOW BI-COLOUR

SI METRIC

THIRD ANGLE PROJECTION

MATERIAL: SEE ORDER

FINISH: N/A

PROJ. FILE NO.

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
0	05/07/07	CTS	RELEASED	CTS	DG

BREAK ALL SHARP CORNERS TO .002-.005 RADIUS AND REMOVE ALL BURRS

DRG SCALE - A1

DIMENSIONS IN INCHES

REF -

EMERSON. PROCESS MANAGEMENT

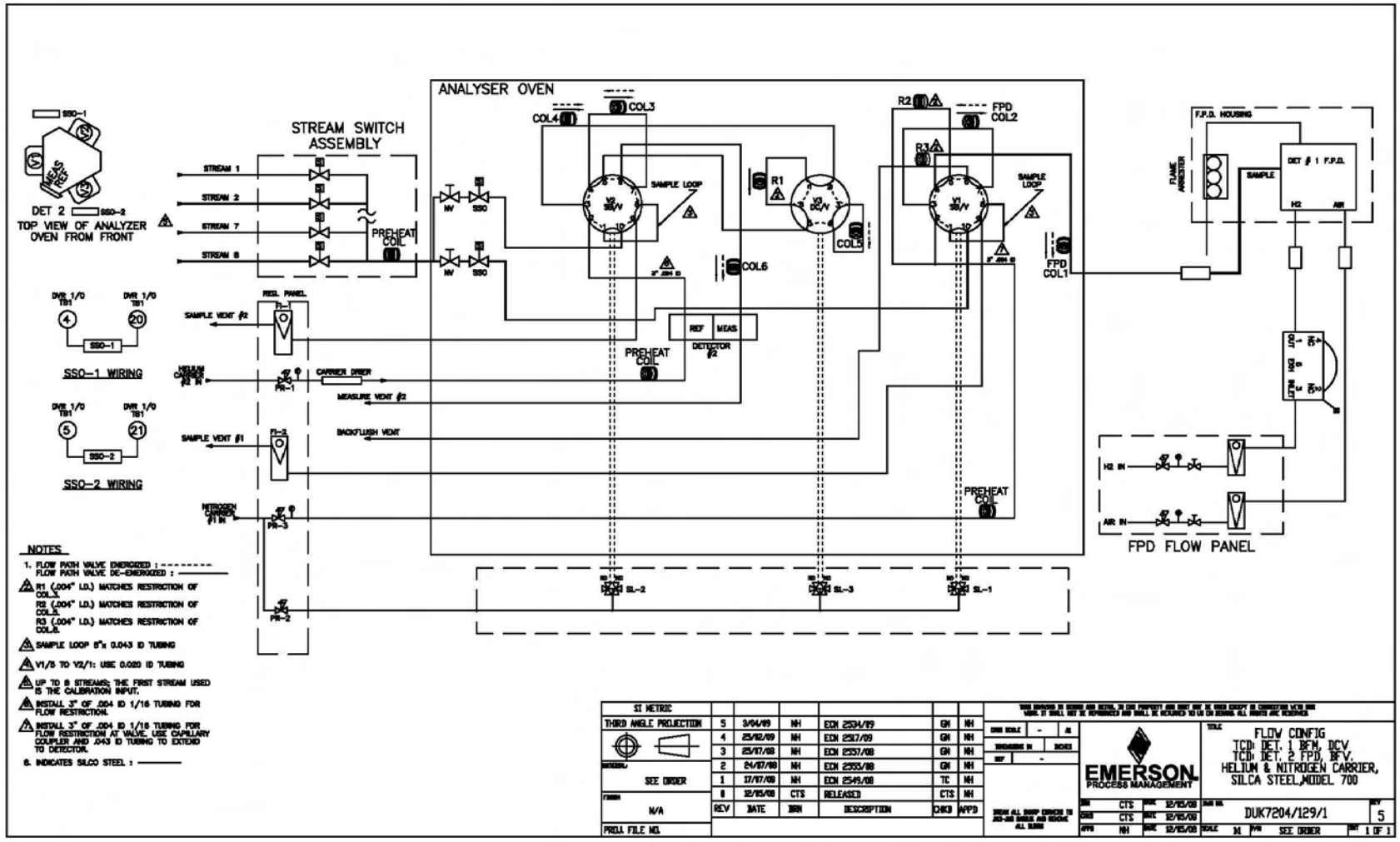
DRN	CTS	DATE	05/07/07
CHKD	CTS	DATE	05/07/07
APPD	NH	DATE	05/07/07

TITLE

MODEL 700 FPD MODULE POWER DIAGRAM

DWG NO. DUK7204/103/1 REV 0

SCALE 1:1 P/N SEE ORDER SHT 1 OF 1



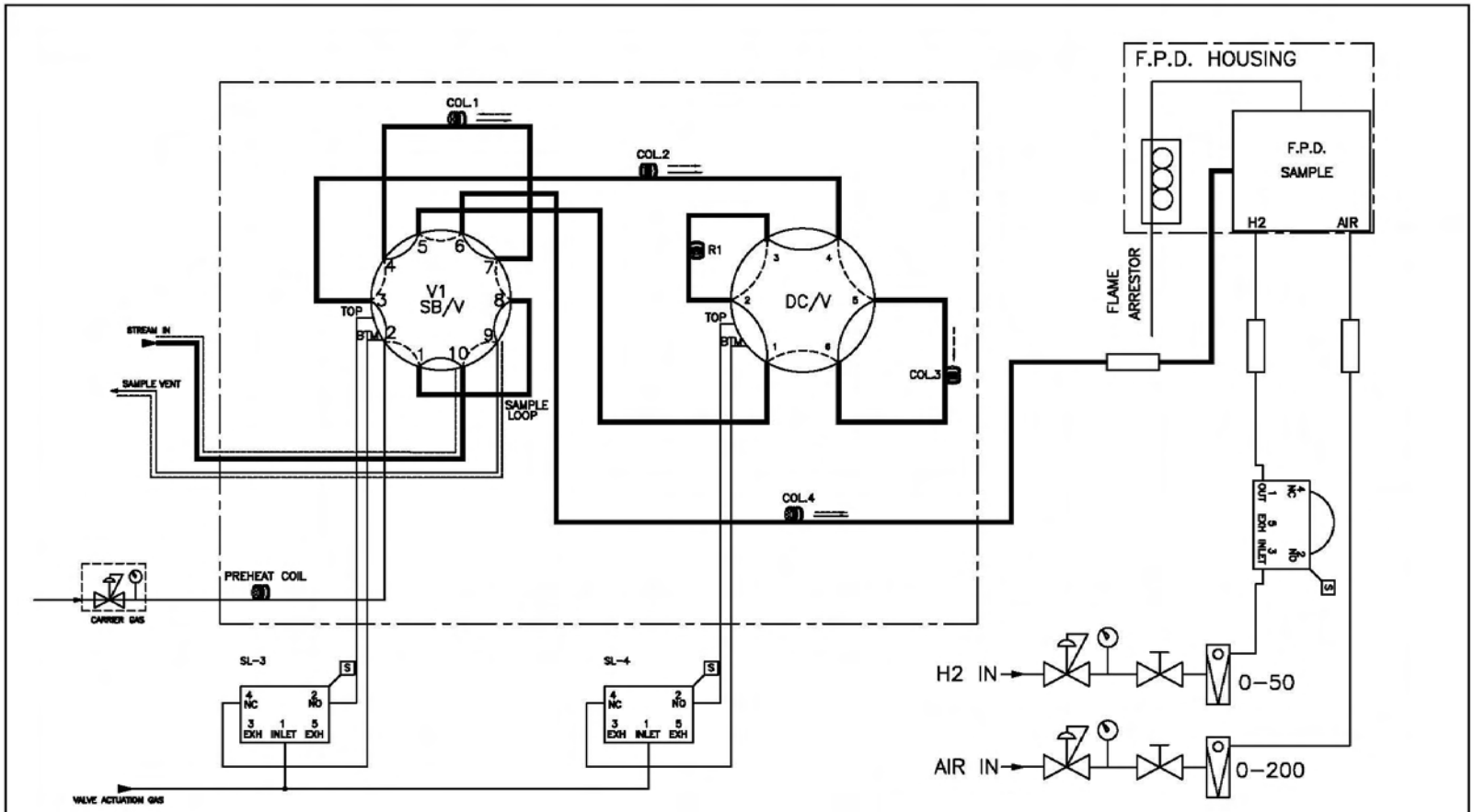
SI METRIC						
THIRD ANGLE PROJECTION	5	3/04/09	NH	ECN 2534/09	GM	NH
	4	25/02/09	NH	ECN 2517/09	GM	NH
	3	23/07/08	NH	ECN 2557/08	GM	NH
	2	24/07/08	NH	ECN 2555/08	GM	NH
	1	17/07/08	NH	ECN 2549/08	TC	NH
MATERIAL: SEE ORDER	0	12/05/08	CTS	RELEASED	CTS	NH
FINISH: N/A	REV	DATE	DRN	DESCRIPTION	CHKD	APP'D
PROJ. FILE NO.						

DRAW ALL SHARP EDGES TO ANSI-ASME RADIUS AND REMOVE ALL BURRS

EMERSON PROCESS MANAGEMENT

TITLE: FLOW CONFIG
TCD: DET. 1 BFM, DCV.
TCD: DET. 2 FPD, BFV.
HELIUM & NITROGEN CARRIER,
SILCA STEEL, MODEL 700

DRN	CTS	12/05/08	DWG NO. DUK7204/129/1 REV 5
CHKD	CTS	12/05/08	
APP'D	NH	12/05/08	SCALE NTS FSN SEE ORDER SHT 1 OF 1



1. BOLD LINES INDICATE SILCOSTEEL
2. DASHED LINES INDICATE HEATED LINES

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
1	06/10/08	NH	ECN 2580/08	GM	NH
0	07/07/08	CTS	RELEASED	CTS	NH

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BEN ORDER
FINISH: N/A

DRG SCALE - A3
DIMENSIONS IN INCHES
REF -

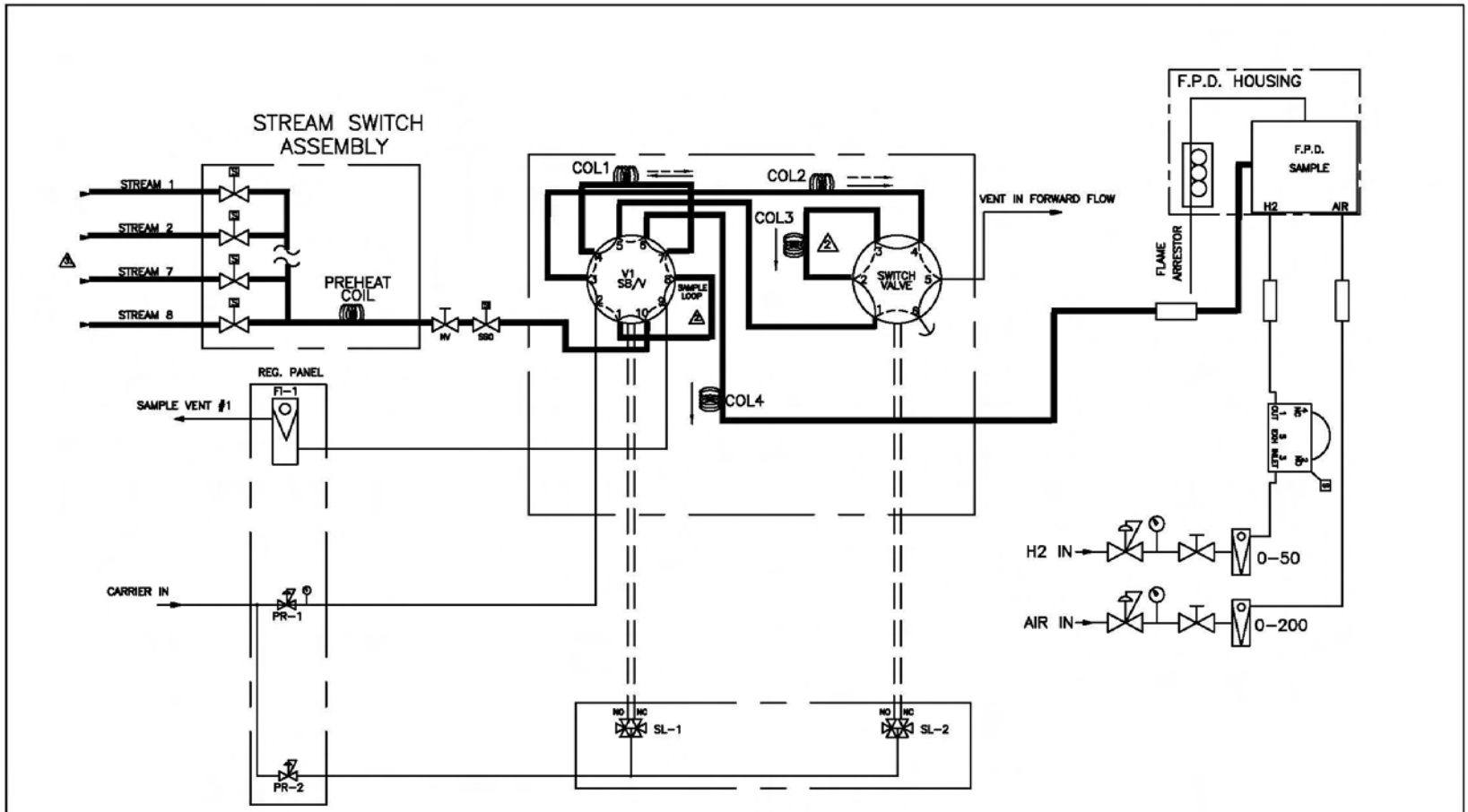
BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

EMERSON. PROCESS MANAGEMENT

DRN	CTS	DATE 07/07/08
CHKD	CTS	DATE 07/07/08
APPD	NH	DATE 07/07/08

TITLE
MODEL 700 FPD, BFM,DCV
EXTERNAL STREAM SWITCHING
INTERNAL HEATED SAMPLE LINES
SILCOSTEEL

DWG NO. DUK7204/134/1 REV 1
SCALE 1/1 P/N SEE ORDER SHT 1 OF 1



NOTES

1. FLOW PATH VALVE ENERGIZED : - - - - - -
   FLOW PATH VALVE DE-ENERGIZED : ———
2. SAMPLE LOOP 6" x 0.043 ID TUBING.
3. UP TO 8 STREAMS; THE FIRST STREAM USED IS THE CALIBRATION INPUT.
4. BOLD LINES FOR SILCOSTEEL : ■■■

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
1	23/09/08	NH	ECN 2578/08	GM	NH
0	07/07/08	CTS	RELEASED	CTS	NH

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: SEE ORDER
FINISH: N/A

DRG SCALE - NI
DIMENSIONS IN INCHES
REF -

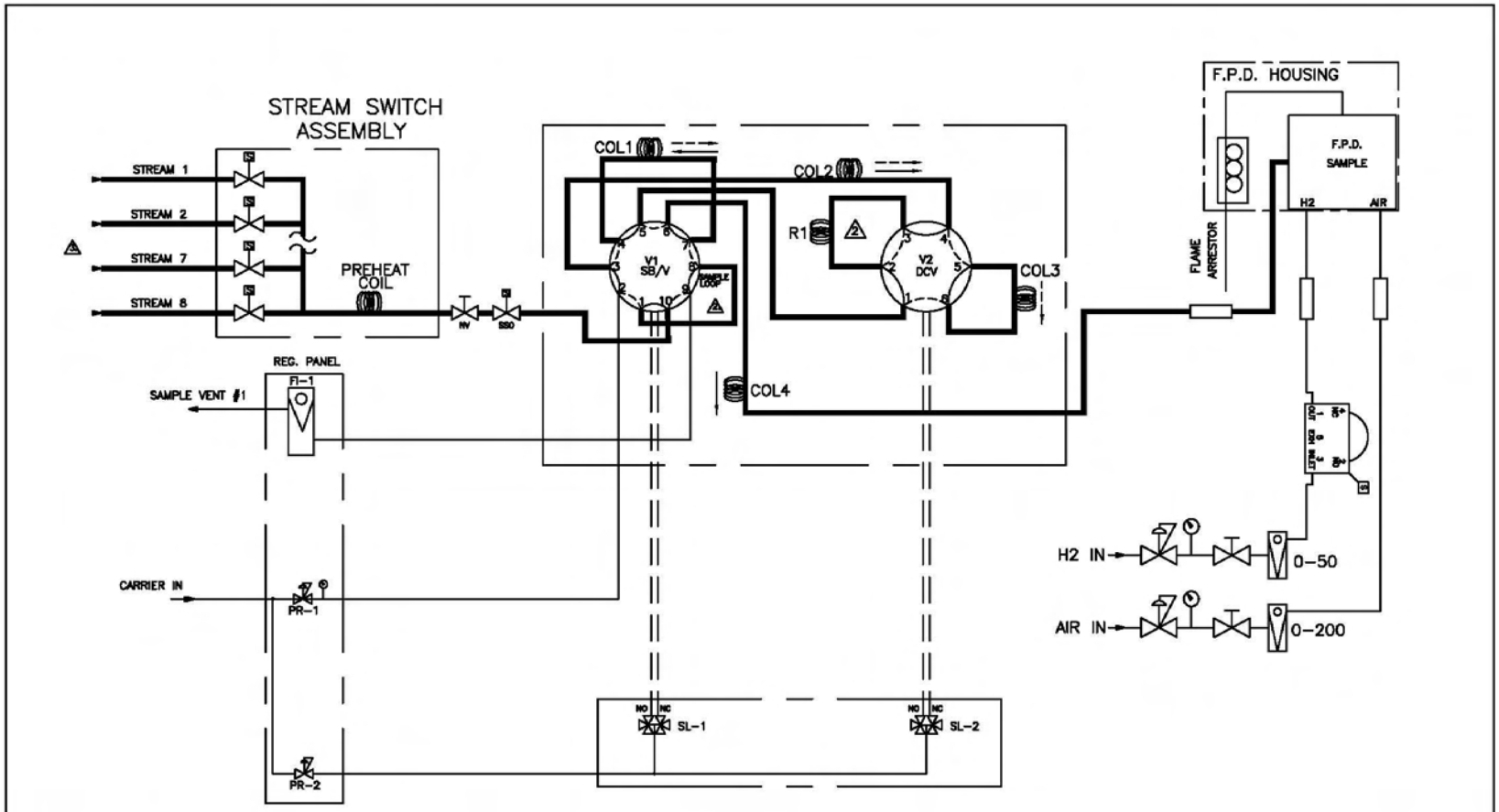
BREAK ALL SHARP CORNERS TO .003-.005 RADIUS AND REMOVE ALL BURRS

EMERSON PROCESS MANAGEMENT

TITLE: MODEL 700, BFM, SWITCHVALVE INTERNAL STREAM SWITCHING SILCOSTEEL

DRN	CTS	DATE	07/07/08
CHKD	CTS	DATE	07/07/08
APPD	NH	DATE	07/07/08

DWG NO. DUK7204/136/1 REV 1
SCALE 1:1 P/N SEE ORDER SHT 1 OF 1



NOTES

1. FLOW PATH VALVE ENERGIZED : - - - - - -
   FLOW PATH VALVE DE-ENERGIZED : ———
2. SAMPLE LOOP 6" x 0.043 ID TUBING.
3. UP TO 8 STREAMS; THE FIRST STREAM USED IS THE CALIBRATION INPUT.

SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: SEE ORDER						
FINISH: N/A						
	0	07/07/08	CTS	RELEASED	CTS	NH
	REV	DATE	DRN	DESCRIPTION	CHKD	APPD

DRG SCALE - A1
DIMENSIONS IN INCHES
REF -

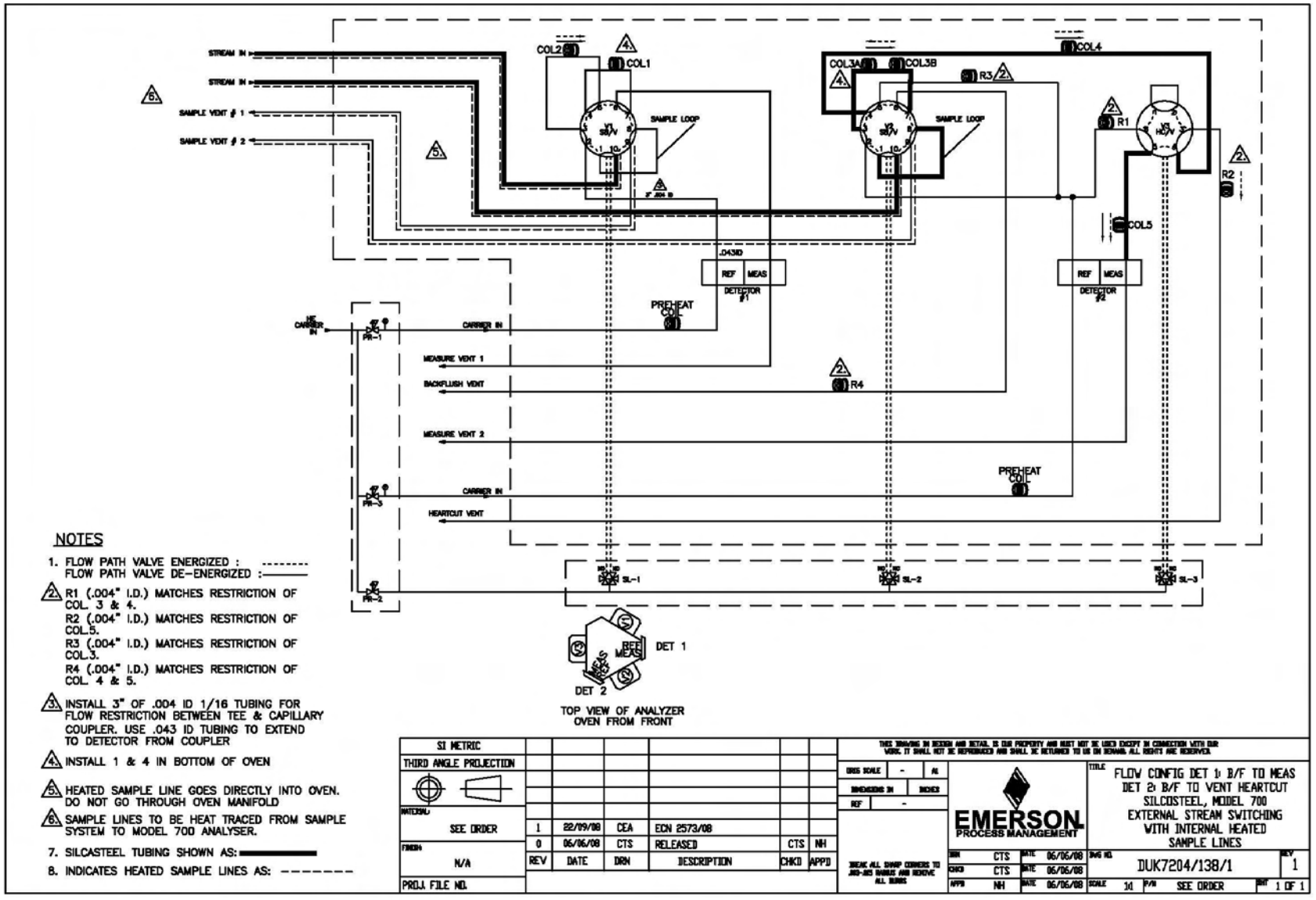
BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

EMERSON PROCESS MANAGEMENT

DRN	CTS	DATE	07/07/08
CHKD	CTS	DATE	07/07/08
APPD	NH	DATE	07/07/08

TITLE
MODEL 700, FPD
BFM, DCV
INTERNAL STREAM SWITCHING
SILCOSTEEL

DWG NO. DUK7204/137/1 REV 0
SCALE 1:1 P/N SEE ORDER SHT 1 OF 1



TOP VIEW OF ANALYZER OVEN FROM FRONT

NOTES

1. FLOW PATH VALVE ENERGIZED : --------
   FLOW PATH VALVE DE-ENERGIZED : ———
2. R1 (.004" I.D.) MATCHES RESTRICTION OF COL. 3 & 4.
   R2 (.004" I.D.) MATCHES RESTRICTION OF COL.5.
   R3 (.004" I.D.) MATCHES RESTRICTION OF COL.3.
   R4 (.004" I.D.) MATCHES RESTRICTION OF COL. 4 & 5.
3. INSTALL 3" OF .004 ID 1/16 TUBING FOR FLOW RESTRICTION BETWEEN TEE & CAPILLARY COUPLER. USE .043 ID TUBING TO EXTEND TO DETECTOR FROM COUPLER
4. INSTALL 1 & 4 IN BOTTOM OF OVEN
5. HEATED SAMPLE LINE GOES DIRECTLY INTO OVEN. DO NOT GO THROUGH OVEN MANIFOLD
6. SAMPLE LINES TO BE HEAT TRACED FROM SAMPLE SYSTEM TO MODEL 700 ANALYSER.
7. SILCASTEEL TUBING SHOWN AS: ———
8. INDICATES HEATED SAMPLE LINES AS: --------

SI METRIC						
THIRD ANGLE PROJECTION						
MATERIAL: SEE ORDER	1	22/09/08	CEA	ECN 2573/08		
	0	06/06/08	CTS	RELEASED	CTS	NH
FINISH: N/A	REV	DATE	DRN	DESCRIPTION	CHKD	APPD
PROJ. FILE NO.						

UNLESS SCALE - A1
DIMENSIONS IN INCHES
REF -

BREAK ALL SHARP CORNERS TO .005-.015 RADIUS AND REMOVE ALL BURRS

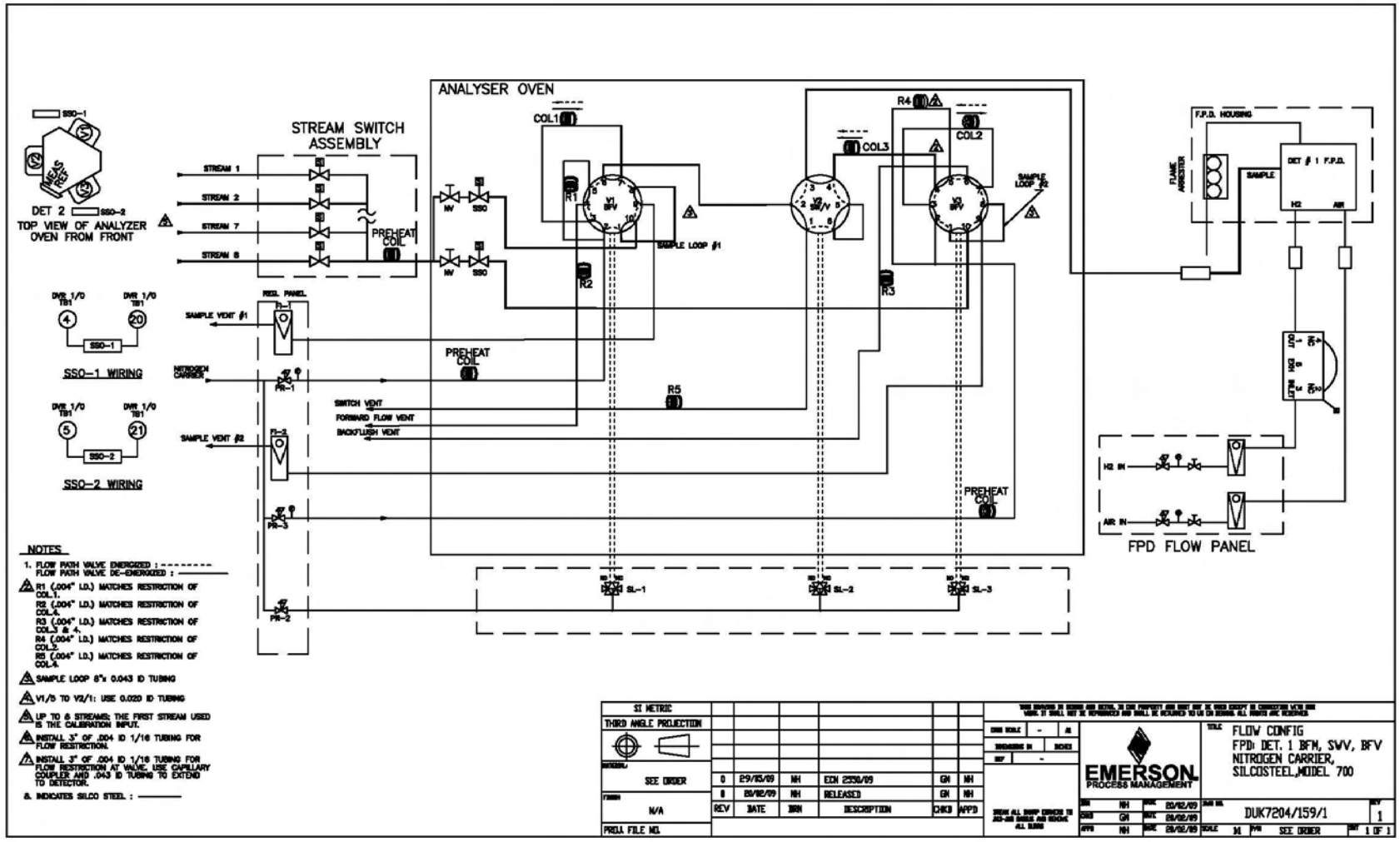
EMERSON PROCESS MANAGEMENT

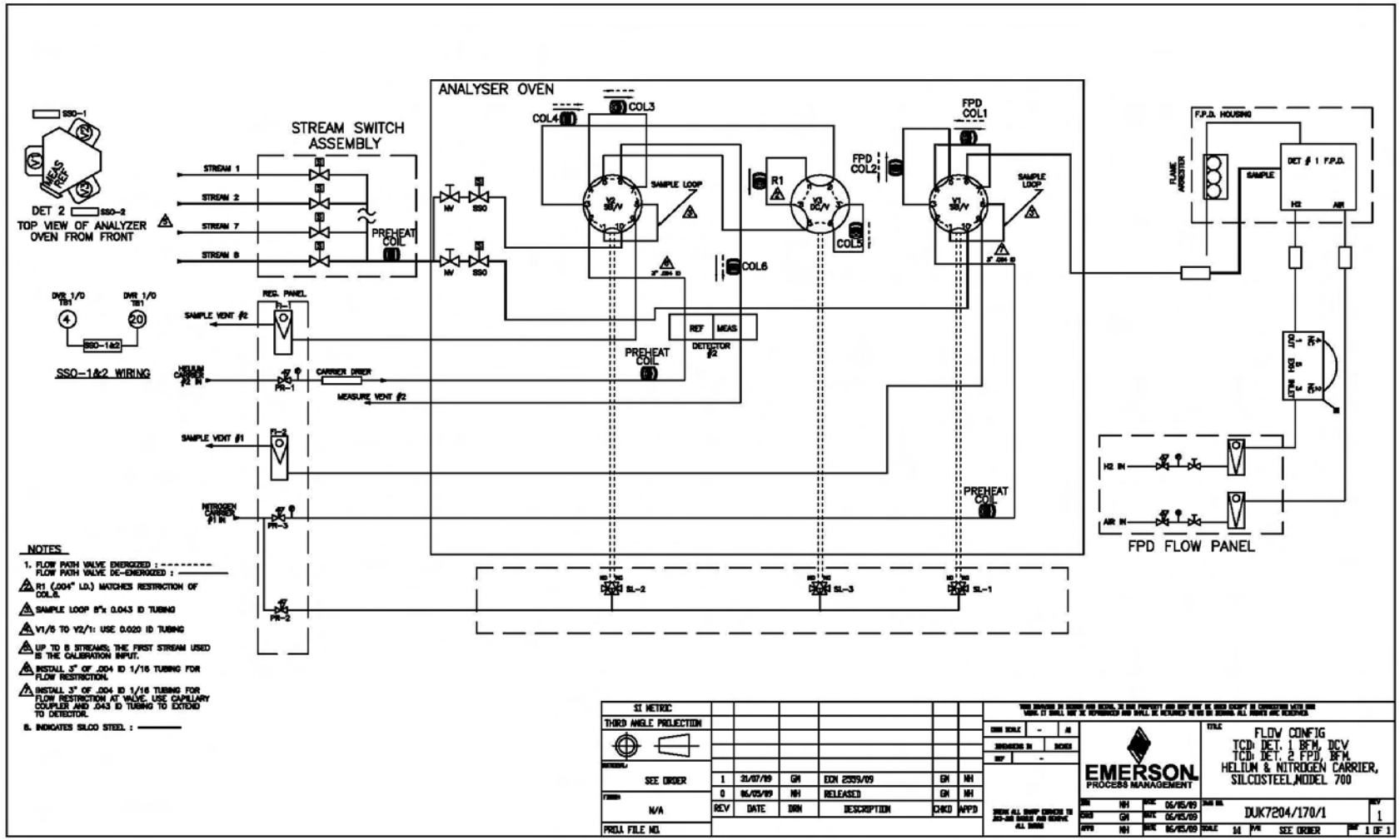
DRN	CTS	DATE	06/06/08
CHKD	CTS	DATE	06/06/08
APPD	NH	DATE	06/06/08

TITLE: FLOW CONFIG DET 1: B/F TO MEAS
DET 2: B/F TO VENT HEARTCUT
SILCOSTEEL, MODEL 700
EXTERNAL STREAM SWITCHING
WITH INTERNAL HEATED
SAMPLE LINES

DWG NO. DUK7204/138/1 REV. 1

SCALE 1:1 P/N SEE ORDER SHT 1 OF 1


ANALYSER OVEN
STREAM SWITCH ASSEMBLY
STREAM 1
STREAM 2
STREAM 7
STREAM 8
PREHEAT COL
COL1
COL2
COL3
R1
R2
R3
R4
R5
SAMPLE LOOP #1
SAMPLE LOOP #2
SAMPLE VENT #1
SAMPLE VENT #2
NITROGEN CARRIER
SWITCH VENT
FORWARD FLOW VENT
BACKFLUSH VENT
PR-1
PR-2
PR-3
SL-1
SL-2
SL-3
SSO-1
SSO-2
DET 2
TOP VIEW OF ANALYZER OVEN FROM FRONT
SSO-1 WIRING
SSO-2 WIRING
F.P.D. HOUSING
FLAME ARRESTER
DET # 1 F.P.D.
SAMPLE
H2
AIR
H2 IN
AIR IN
FPD FLOW PANEL
NOTES
1. FLOW PATH VALVE ENERGIZED : ---------
FLOW PATH VALVE DE-ENERGIZED : ———
R1 (.004" I.D.) MATCHES RESTRICTION OF COL.1.
R2 (.004" I.D.) MATCHES RESTRICTION OF COL.4.
R3 (.004" I.D.) MATCHES RESTRICTION OF COL.3 & 4.
R4 (.004" I.D.) MATCHES RESTRICTION OF COL.2.
R5 (.004" I.D.) MATCHES RESTRICTION OF COL.4.
SAMPLE LOOP 6"x 0.043 ID TUBING
V1/5 TO V2/1: USE 0.020 ID TUBING
UP TO 6 STREAMS; THE FIRST STREAM USED IS THE CALIBRATION INPUT.
INSTALL 3" OF .004 ID 1/16 TUBING FOR FLOW RESTRICTION.
INSTALL 3" OF .004 ID 1/16 TUBING FOR FLOW RESTRICTION AT VALVE. USE CAPILLARY COUPLER AND .043 ID TUBING TO EXTEND TO DETECTOR.
& INDICATES SILCO STEEL : ———
SI METRIC
THIRD ANGLE PROJECTION
SEE ORDER
N/A
PROJ. FILE NO.
0 29/05/09 NH ECN 2230/09 GH NH
B 26/02/09 NH RELEASED GH NH
REV DATE DRN DESCRIPTION CHKD APP'D
EMERSON PROCESS MANAGEMENT
FLOW CONFIG
FPD: DET. 1 BFM, SWV, BFV
NITROGEN CARRIER,
SILCOSTEEL,MODEL 700
DUK7204/159/1
SEE ORDER
1 OF 1


ANALYSER OVEN
STREAM SWITCH ASSEMBLY
STREAM 1
STREAM 2
STREAM 7
STREAM 8
PREHEAT COL
SAMPLE LOOP
R1
COL1
COL2
COL3
COL4
COL5
COL6
FPD COL1
FPD COL2
REF
MEAS
DETECTOR #2
SAMPLE VENT #2
SAMPLE VENT #1
CARRIER ORDER
MEASURE VENT #2
PR-1
PR-2
PR-3
SL-1
SL-2
SL-3
F.P.D. HOUSING
DET # 1 F.P.D.
FLAME ARRESTER
SAMPLE
H2
AIR
H2 IN
AIR IN
FPD FLOW PANEL
DET 2
TOP VIEW OF ANALYZER OVEN FROM FRONT
SSO-1&2 WIRING
NOTES
1. FLOW PATH VALVE ENERGIZED : ---------
FLOW PATH VALVE DE-ENERGIZED : ———
R1 (.004" I.D.) MATCHES RESTRICTION OF COL 6.
SAMPLE LOOP 8"x 0.043 ID TUBING
V1/5 TO Y2/1: USE 0.020 ID TUBING
UP TO 8 STREAMS; THE FIRST STREAM USED IS THE CALIBRATION INPUT.
INSTALL 3" OF .004 ID 1/16 TUBING FOR FLOW RESTRICTION.
INSTALL 3" OF .004 ID 1/16 TUBING FOR FLOW RESTRICTION AT VALVE. USE CAPILLARY COUPLER AND .043 ID TUBING TO EXTEND TO DETECTOR.
6. INDICATES SILCO STEEL : ———
SI METRIC
THIRD ANGLE PROJECTION
SEE ORDER
N/A
PROJ FILE NO.
1 31/07/09 GH ECN 2539/09 GH NH
0 06/05/09 NH RELEASED GH NH
REV DATE DRN DESCRIPTION CHKD APP'D
EMERSON PROCESS MANAGEMENT
FLOW CONFIG
TCD: DET. 1 BFM, DCV
TCD: DET. 2 FPD, BFM,
HELIUM & NITROGEN CARRIER,
SILCOSTEEL,MODEL 700
DUK7204/170/1
1
SEE ORDER
1 OF 1

APPENDIX C

DETECTOR MANUAL

Flame Photometric 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.**

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 O-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 florescent 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 and signal cables to the back of the PMT.

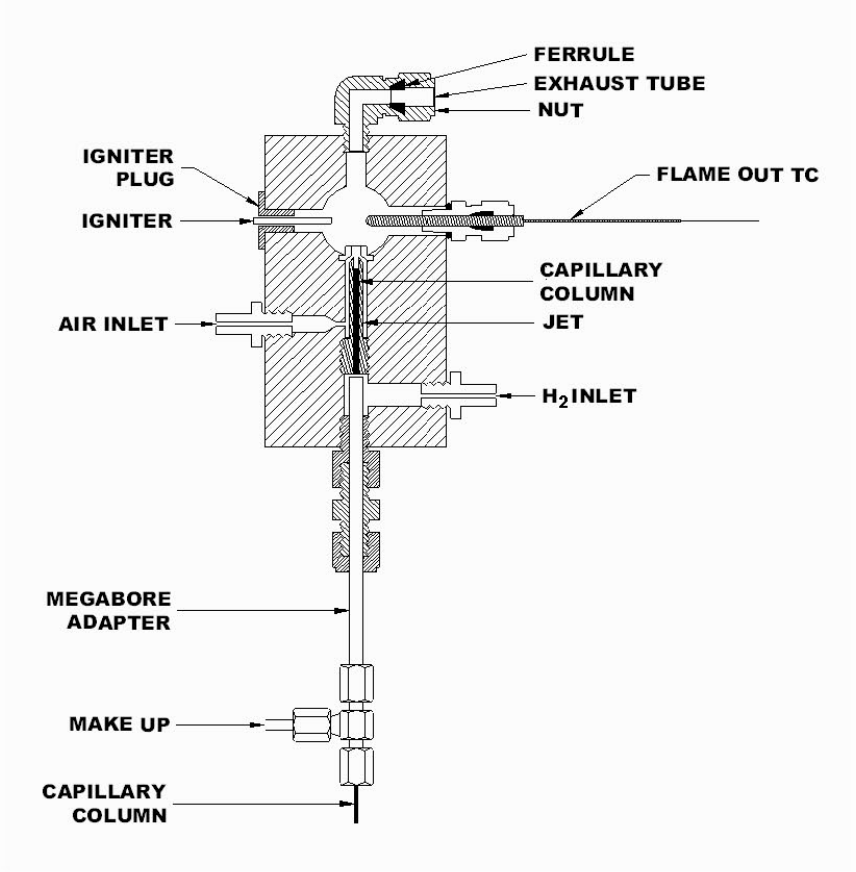


Figure 1
Insertion of Capillary Column into the FPD

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. Care should be taken 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 damage to the plastic photomultiplier tube 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 columns 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 S_2 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.

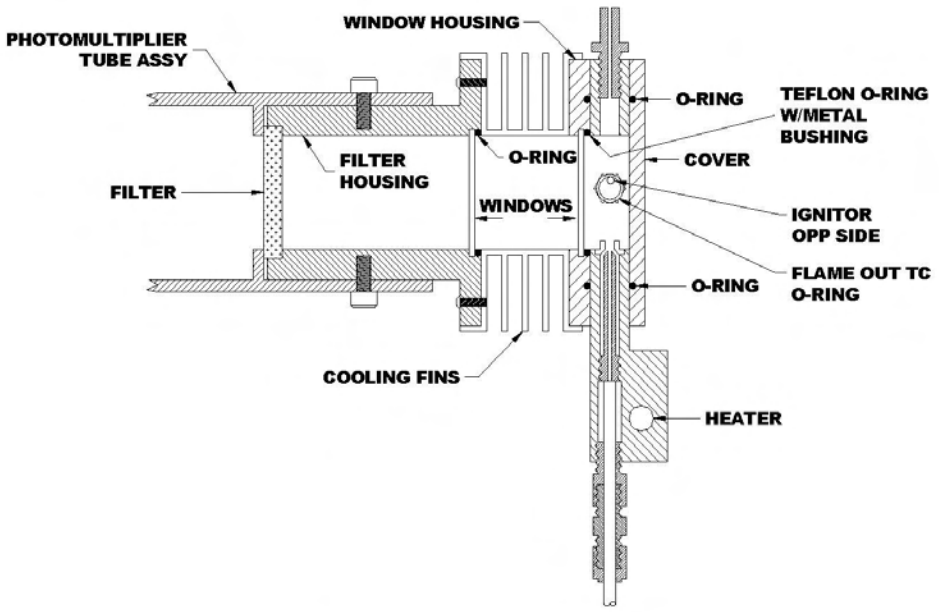


Figure 2
Replacement of O-rings and Windows

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 with out disassembly. Follow the procedure listed below:

1. Disconnect the electrical connections from the detector.
2. Turn 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, P/N 116910-KALREZ. Four are Kalrez and one is Teflon. The locations of these O-rings are shown in **Figure 2**. These O-rings must be replaced any time a joint sealed by one of them is separated. The cross section view of the detector is shown in **Figure 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.

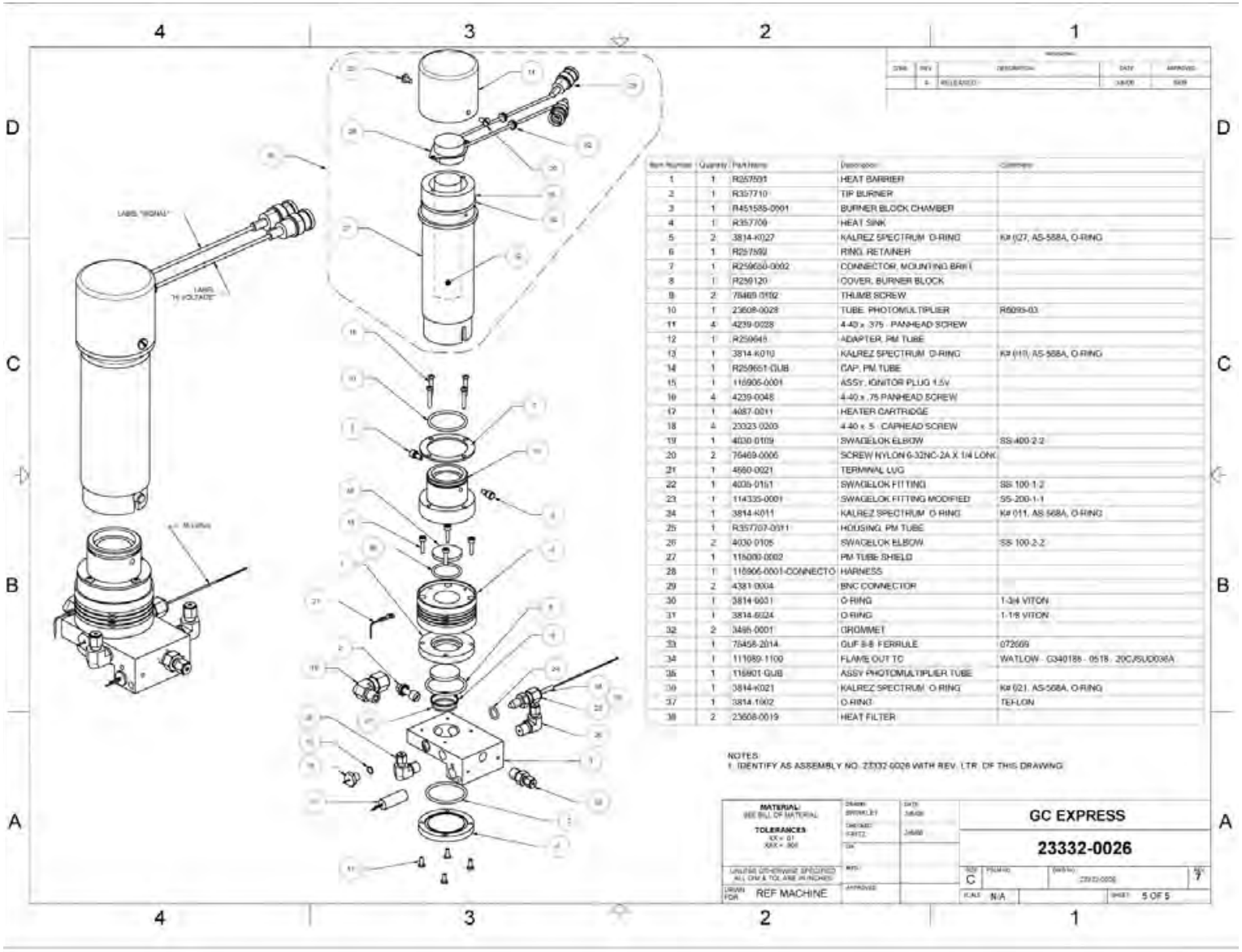
5. Pull the filter housing from the recess in the heat radiator exposing the first window and O-ring (15/16" Kalrez).
6. With a hex (Allen) wrench, remove the four screws holding the radiator and window housing to the flame base.
7. Remove the heat radiator, window housing, and the window.
8. Remove the old O-rings.
9. Place the 15/16" Teflon ring around the metal bushing.
10. Insert the 1-1/4" 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" 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" Kalrez end cover O-ring is located between the end cover and the flame base.

Recommended Spare Parts

Figure 2 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	116910-KALREZ
2 ea. # 2-27 Kalrez (1.437 O.D. x .070 dia cross section.)	
1 ea. # 2-21 Kalrez (1.062 O.D. x .070 dia cross section.)	
1 ea. # C2118-021 Teflon (1.062 O.D. x .070 cross section)	
1 ea. # 568-010 Kalrez O-ring # S70010 Ignitor	
1 ea. # 586-011 Kalrez O-ring # S70011 Flame Out TC	



Item Number	Quantity	Part Name	Description	Comments
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	R259648	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	23023-0203	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	4006-0151	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	116000-0002	PM TUBE SHIELD	
28	1	116906-0001-CONNECTO	HARNESS	
29	2	4381-0004	BNC CONNECTOR	
30	1	3814-0031	O-RING	1-3/4 VITON
31	1	3814-6024	O-RING	1-1/8 VITON
32	2	3496-0001	GROMMET	
33	1	76458-2014	GUF 8-8 FERRULE	072609
34	1	111089-1100	FLAME OUT TC	WATLOW - G340188 - 0518 - 20CJSUD036A
35	1	116801 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	

NOTES:
1. IDENTIFY AS ASSEMBLY NO. 23332-0026 WITH REV. LTR. OF THIS DRAWING

MATERIAL: SEE BILL OF MATERIAL
TOLERANCES: XX = .01, XXX = .005
UNLESS OTHERWISE SPECIFIED ALL DIM & TOLARE IN INCHES
DRAWN FOR: REF MACHINE
DRAWN: BROMLEY
CHECKED: KURTZ
QA:
MFG:
APPROVED:
DATE: 3/6/08, 3/6/08

GC EXPRESS

23332-0026

SIZE: C | FSCM NO: | SHEET: 5 OF 5 | REV: 7
SCALE: N/A

GUB FPD
118500-3411 GUB

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/O Switch) (SW1), suspending any automatic operation until the R/R/O Switch is set to the RUN position. If the R/R/O 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/O Switch is manually switched to either the Reset or Run position.
   C. Igniter and Flame on State. When the R/R/O Switch is set to the RUN position, the uP attempts to ignite the flame. The ignition sequence consists of the following steps.
      1. Turn 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. Turn 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 CON3.1. The uP will suspend any other operation until the R/R/O 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/O Switch is set to RUN.
         b. Anytime the R/R/O Switch is cycled from RESET or OVERRIDE to RUN.
         c. In normal 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/O Switch has been manually cycled off and back on or the power has been turned off and back on.

      Any time the R/R/O 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/O Switch is returned to the RUN position.

      Warning: The R/R/O 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 setup of the fuel flow only. To de-activate the fuel valve, the R/R/O Switch must be manually switched back to the RUN or RESET positions.

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

2. **FPD Electrometer Power Supply:**
   Use caution. AC Voltage (120Volts AC) is present and DC Voltage in excess of 600 Volts is generated on the PCB when power is applied.
   A. **External 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 1 & 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 high voltage**:
      On board high voltage converter generates approximately 650 Volt DC (J4)

3. **FPD Linear Mode Test**
   A. Set the Linear / Sq. Root Switch (SW3) to Linear Mode
   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 and the 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 -1.15V to -1.55V. Return the Zero voltage control to approx. 0Volts output.
   E. Connect a current source to the Signal In input connector (J3). With a Voltmeter or recorder, monitor the output at the 10V output pin (CON1.4). Change recorder span as necessary to check output range and linearity per following table.

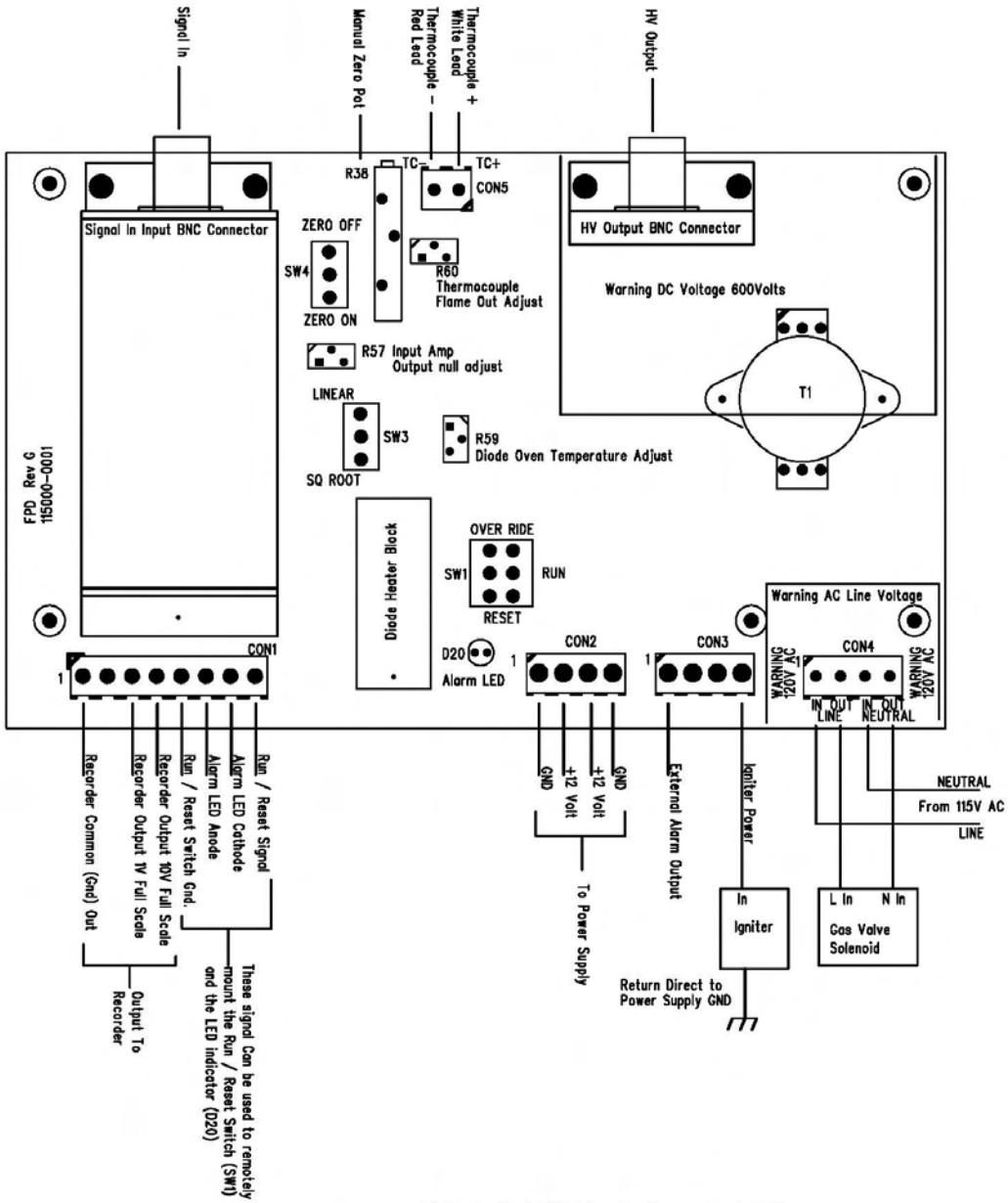
Current Source Setting (AMPS)	Recorder Reading At Direct Output	
-1×10^{-10}	1.0MV	+-2%
-1×10^{-9}	10.0MV	+-2%
-1×10^{-8}	0.100V	+-2%
-1×10^{-7}	1.0V	+-2%
-1×10^{-6}	10.0V	+-2%

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 megohms input impedance minimum) to the 10V output (CON1.4), 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 of R59 so that when temperature stabilizes the recorder or DVM reads 31.56mV as closely as possible.
   F. Reset input current to zero and note recorder/DVM reading. Return input current to -4.0 X 10^{-8} and trim diode oven temperature if necessary so that the difference in recorder/DVM readings for input currents of zero and -4.0 X 10^{-8} amps is 31.56mV, plus or minus 0.1mv.
   G. Check response curve per following table. (If zero reading falls outside permitted limits, readjust the offset pot (R57) and repeat previous step.

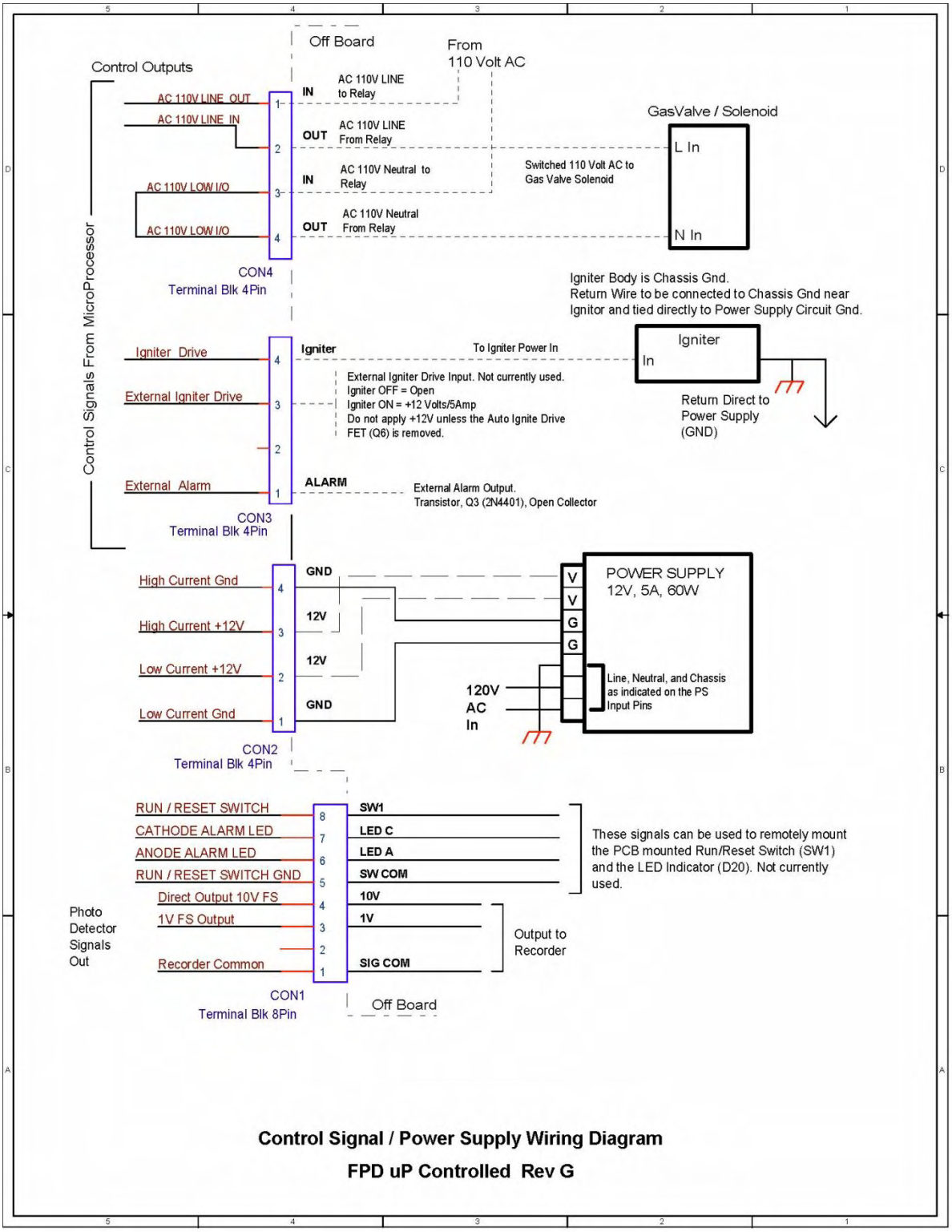
Current Source Setting (AMPS)		Direct Output (10 VFS) Reading (mV)		
-0.00 X 10^{-11}	-0.5 < "Zero" < +0.5	R62=191K	R62=90.9K	
-2.00 X 10^{-11}	"Zero Reading"	+.167 +-.1	+.335 +-.1	
-6.00 X 10^{-11}	"Zero Reading"	+.470 +-.15	+.945 +-.15	
-1.60 X 10^{-10}	"Zero Reading"	+1.16 +-.2	+2.34 +-.2	
-6.40 X 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	Set Point
-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 10MV F.S. recorder to the Direct Output (CON1.4) with the chart speed set to approx. 0.25 cm/min. Disconnect input cable, turn 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 ambient temperature.
   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 hour run.

6. **FPD Thermocouple Temperature Setup.**
   The thermocouple input at CON5 Pin1 and Pin2 will be factory adjusted to operate with Detector temperatures that range from approximately 150 Degrees C to 200 Degrees C.

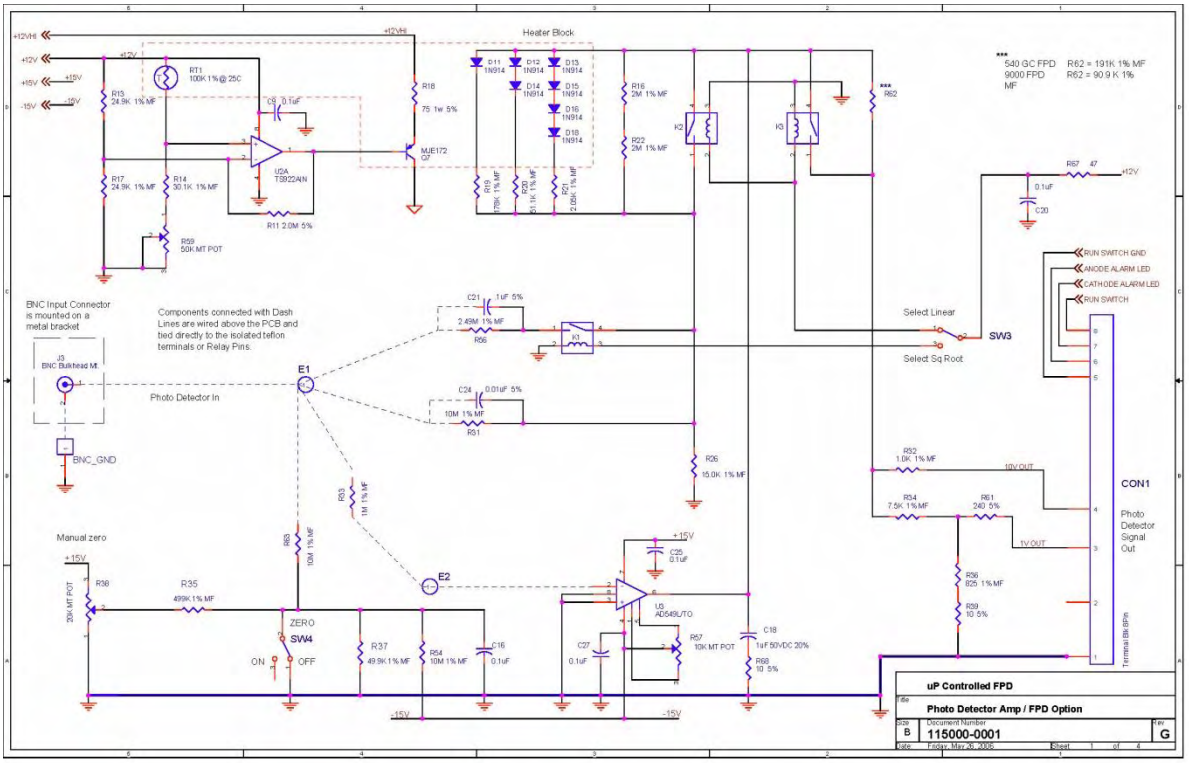


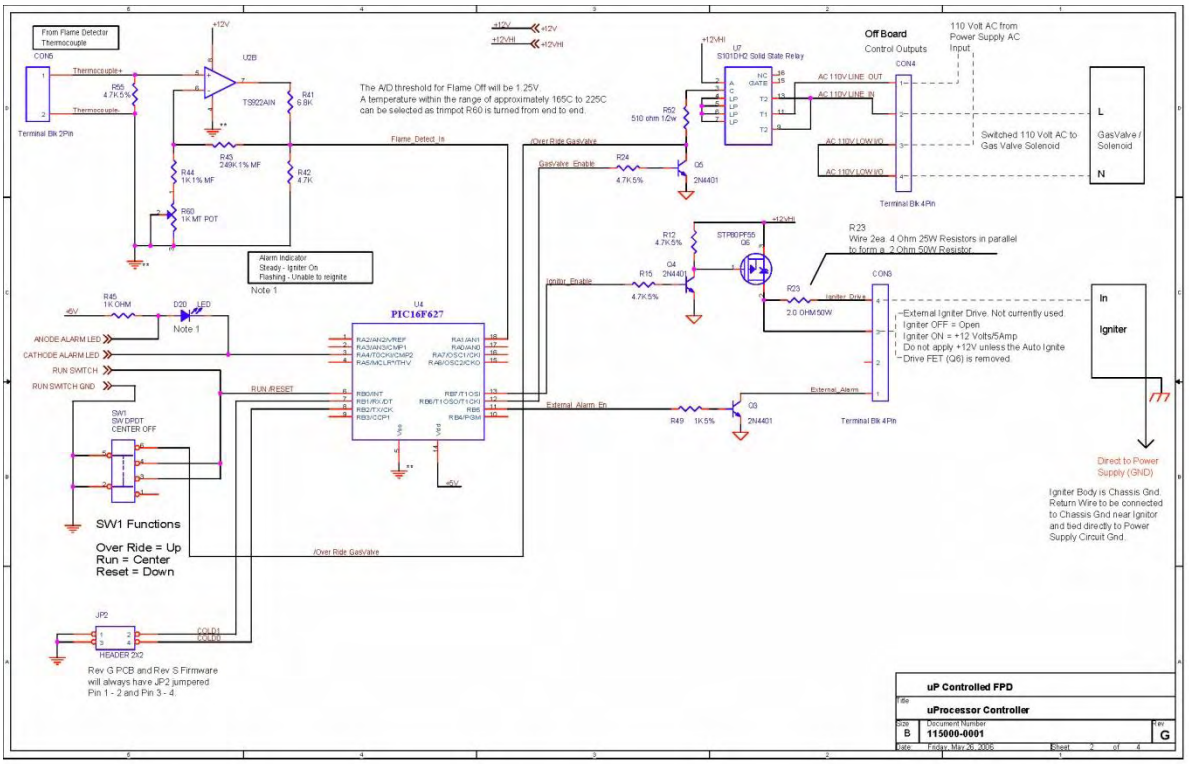
uP Controlled FPD Rev G Component Guide

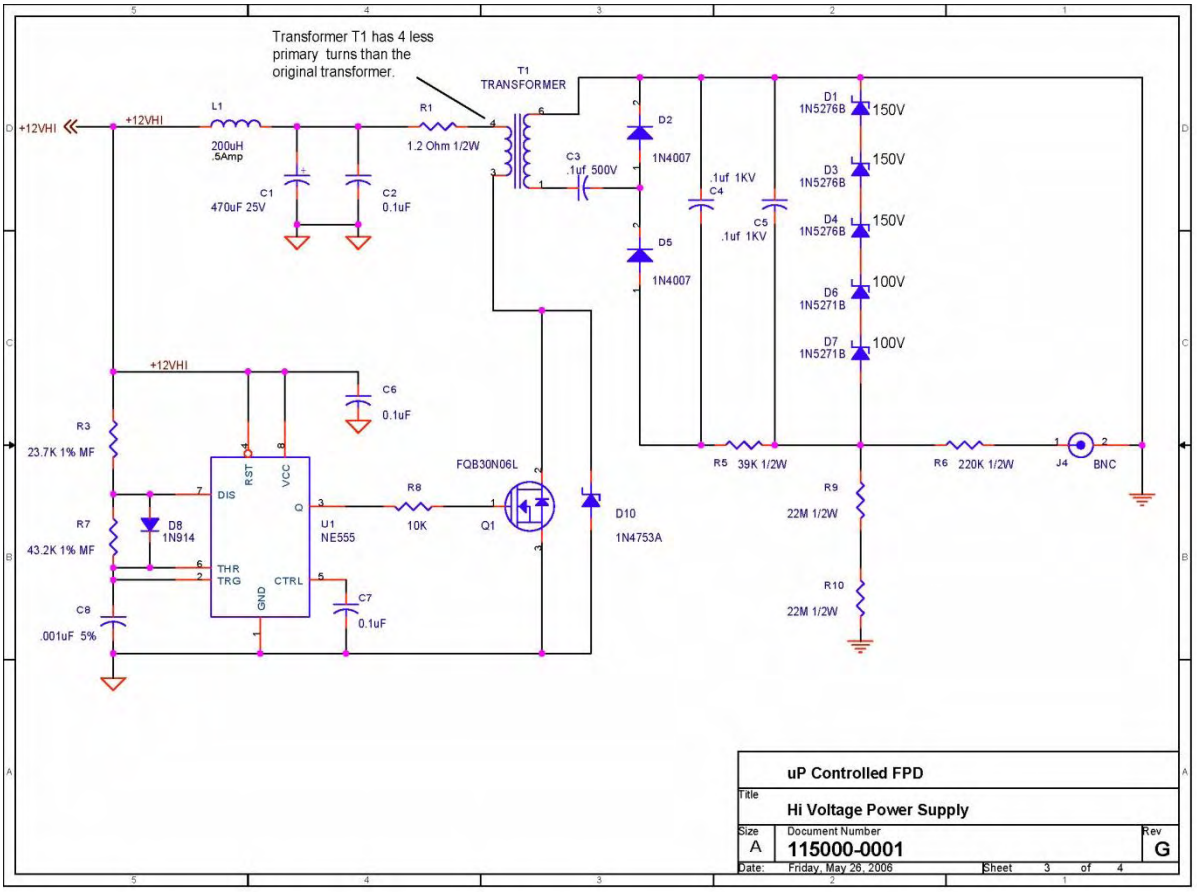


Control Signal / Power Supply Wiring Diagram

FPD uP Controlled Rev G


Heater Block
RT1 100K 1% @ 25C
U2A TS922AIN
MUE172
Q7
R11 2.0M 5%
R59 50K MT POT
R13 24.9K 1% MF
R14 30.1K 1% MF
R17 24.9K 1% MF
R18 75 1w 5%
C8 0.1uF
D11 1N914
D12 1N914
D13 1N914
D14 1N914
D15 1N914
D16 1N914
D18 1N914
R16 2M 1% MF
R22 2M 1% MF
R19 178K 1% MF
R20 45.11K 1% MF
R21 2.05K 1% MF
K2
K3
R62
*** 540 GC FPD R62 = 191K 1% MF
9000 FPD R62 = 90.9 K 1% MF
R67 47
C20 0.1uF
RUN SWITCH GND
ANODE ALARM LED
CATHODE ALARM LED
RUN SWITCH
BNC Input Connector is mounted on a metal bracket
J3 BNC Bulkhead Mt
BNC_GND
Components connected with Dash Lines are wired above the PCB and tied directly to the isolated teflon terminals or Relay Pins.
Photo Detector In
E1
C21 1uF 5%
2.49M 1% MF
R56
K1
Select Linear
Select Sq Root
SW3
C24 0.01uF 5%
10M 1% MF
R51
R26 15.0K 1% MF
R32 1.0K 1% MF
10V OUT
R34 7.5K 1% MF
R61 240 5%
1V OUT
CON1
Photo Detector Signal Out
Terminal Blk 6Pin
R36 825 1% MF
R59 10 5%
R63 10M 1% MF
R53 1M 1% MF
Manual zero
R38 20K MT POT
R35 499K 1% MF
ZERO
SW4
ON
OFF
E2
R37 49.9K 1% MF
R54 10M 1% MF
C16 0.1uF
C25 0.1uF
C27 0.1uF
U3 AD549JUTO
R57 10K MT POT
C18 1uF 50VDC 20%
R68 10 5%
uP Controlled FPD
Photo Detector Amp / FPD Option
Size B
Document Number 115000-0001
Rev G
Date: Friday, May 26, 2006
Sheet 1 of 4


From Flame Detector Thermocouple
CON5
Terminal Blk 2Pin
U2B TS922AIN
R55 4.7K 5%
R41 6.8K
R43 249K 1% MF
R44 1K 1% MF
R40 4.7K
R60 1K MT POT
The A/D threshold for Flame Off will be 1.25V
A temperature within the range of approximately 165C to 225C can be selected as trimpot R60 is turned from end to end.
Flame_Detect_In
Alarm Indicator
Steady - Igniter On
Flashing - Unable to reignite
Note 1
U4 PIC16F627
R45 1K OHM
D20 LED
Note 1
ANODE ALARM LED
CATHODE ALARM LED
RUN SWITCH
RUN SWITCH GND
RUN_RESET
SW1 SW DPDT CENTER OFF
SW1 Functions
Over Ride = Up
Run = Center
Reset = Down
/Over Ride GasValve
JP2
HEADER 2x2
Rev G PCB and Rev S Firmware will always have JP2 jumpered Pin 1 - 2 and Pin 3 - 4.
U7 S101DHD Solid State Relay
R52 510 ohm 1/2w
Q5 2N4401
R24 4.7K 5%
GasValve_Enable
Off Board Control Outputs
CON4
AC 110V LINE OUT
AC 110V LINE IN
AC 110V LOW I/O
AC 110V LOW I/O
Terminal Blk 4Pin
110 Volt AC from Power Supply AC Input
Switched 110 Volt AC to Gas Valve Solenoid
L
GasValve / Solenoid
N
R12 4.7K 5%
STP80PF55 Q6
R23 Wire 2ea. 4 Ohm 25W Resistors in parallel to form a 2 Ohm 50W Resistor
Q4 2N4401
R15 4.7K 5%
Ignitor_Enable
R23 2.0 OHM 50W
Ignitor_Drive
CON6
External Igniter Drive. Not currently used.
Igniter OFF = Open
Igniter ON = +12 Volts/5Amp
Do not apply +12V unless the Auto Ignite Drive FET (Q6) is removed.
In
Igniter
Direct to Power Supply (GND)
Igniter Body is Chassis Gnd. Return Wire to be connected to Chassis Gnd near Ignitor and tied directly to Power Supply Circuit Gnd.
External_Alarm
External_Alarm_En
Q9 2N4401
R49 1K 5%
Terminal Blk 4Pin
uP Controlled FPD
uProcessor Controller
Size B
Document Number 115000-0001
Rev G
Date: Friday, May 26, 2006
Sheet 2 of 4


Transformer T1 has 4 less primary turns than the original transformer.
T1
TRANSFORMER
+12VHI
L1
200uH .5Amp
R1
1.2 Ohm 1/2W
C1
470uF 25V
C2
0.1uF
C3
.1uf 500V
D2
1N4007
D5
1N4007
C4
.1uf 1KV
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
C8
.001uF 5%
D8
1N914
U1
NE555
DIS
RST
VCC
O
THR
TRG
CTRL
GND
R8
10K
FQB30N06L
Q1
D10
1N4753A
C7
0.1uF
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
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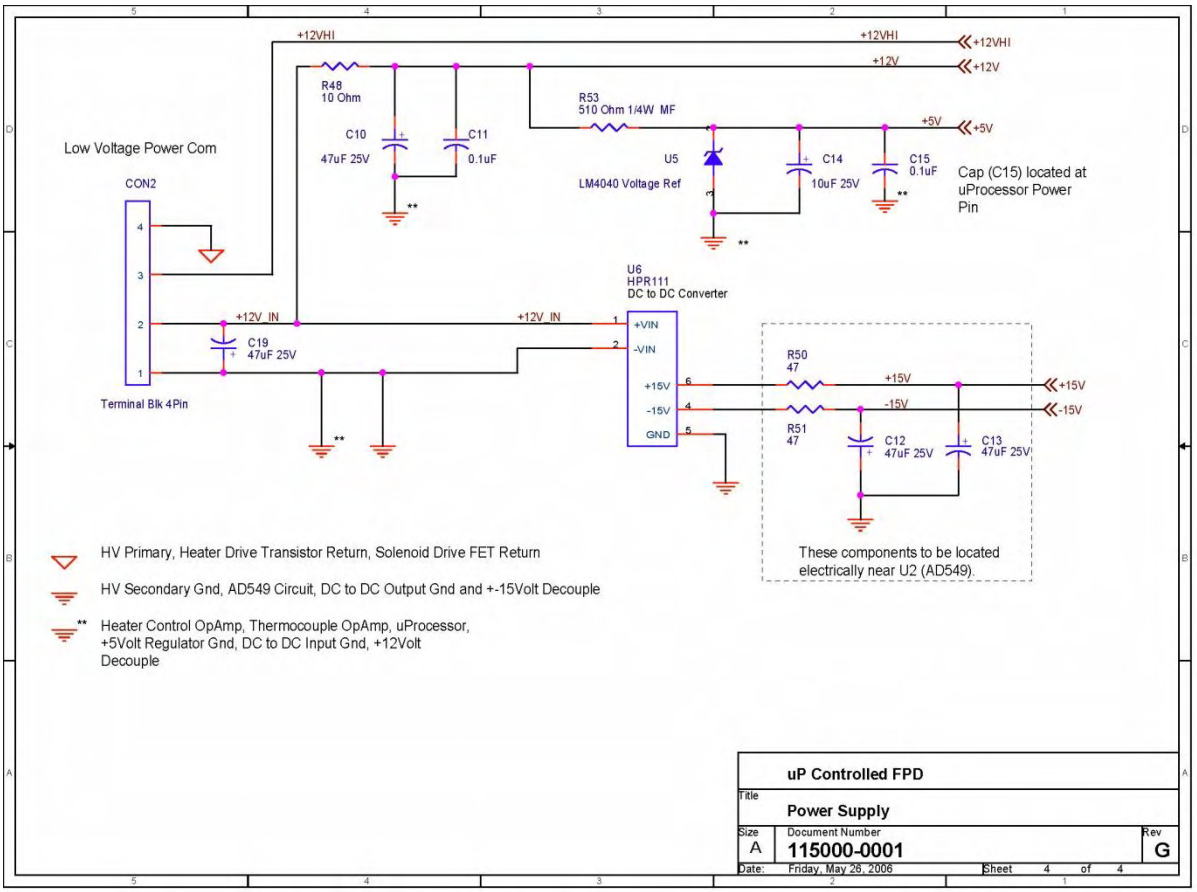
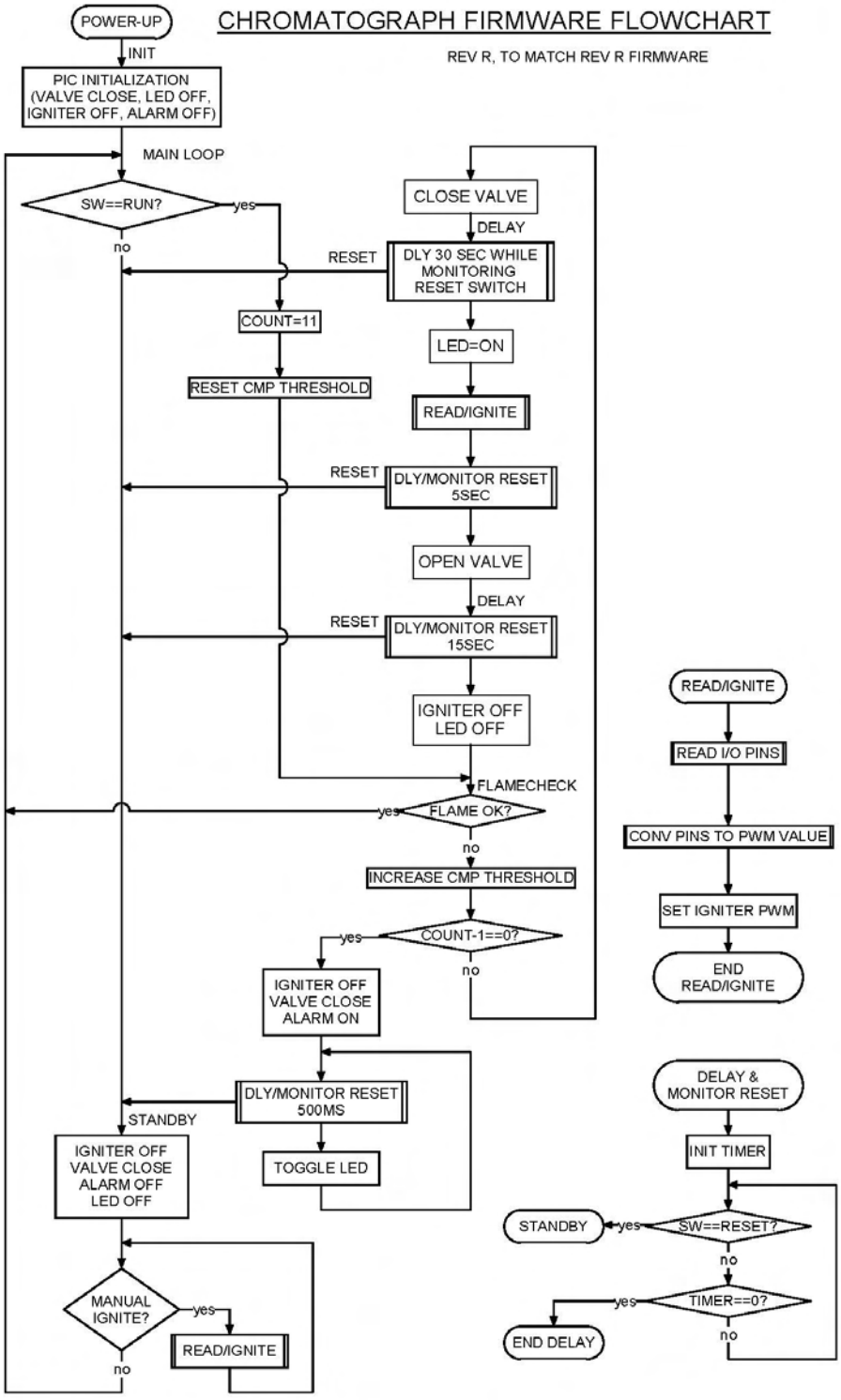
4


+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
C19
47uF 25V
+12V_IN
U6
HPR111
DC to DC Converter
+VIN
-VIN
+15V
-15V
GND
R50
47
R51
47
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



PL118500-3411-GUB

ZONE	REV	DESCRIPTION	DATE	APPROVED

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	5/3/06
CHECKED	FRITZ	5/3/06
QA		
MFG		
APPROVED		

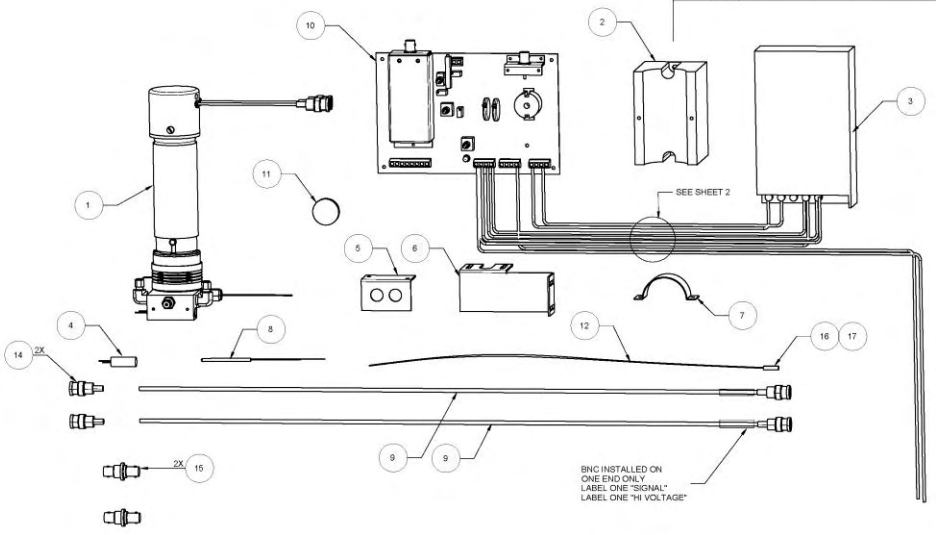
DRWN FOR: **REF MACHINE**

FPD ASSEMBLY KIT

SIZE	FSCM NO.	DWG NO.	REV
B		PL118500-3411-GUB	7

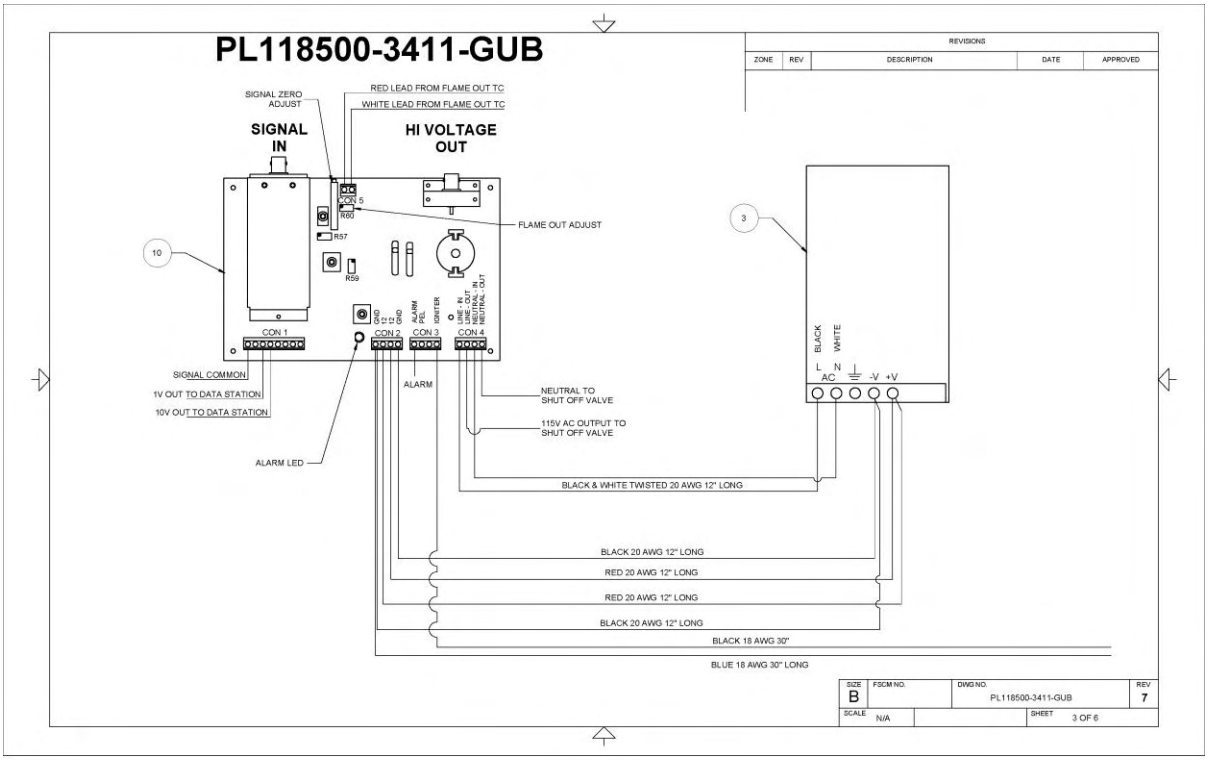
SCALE N/A SHEET 1 OF 6

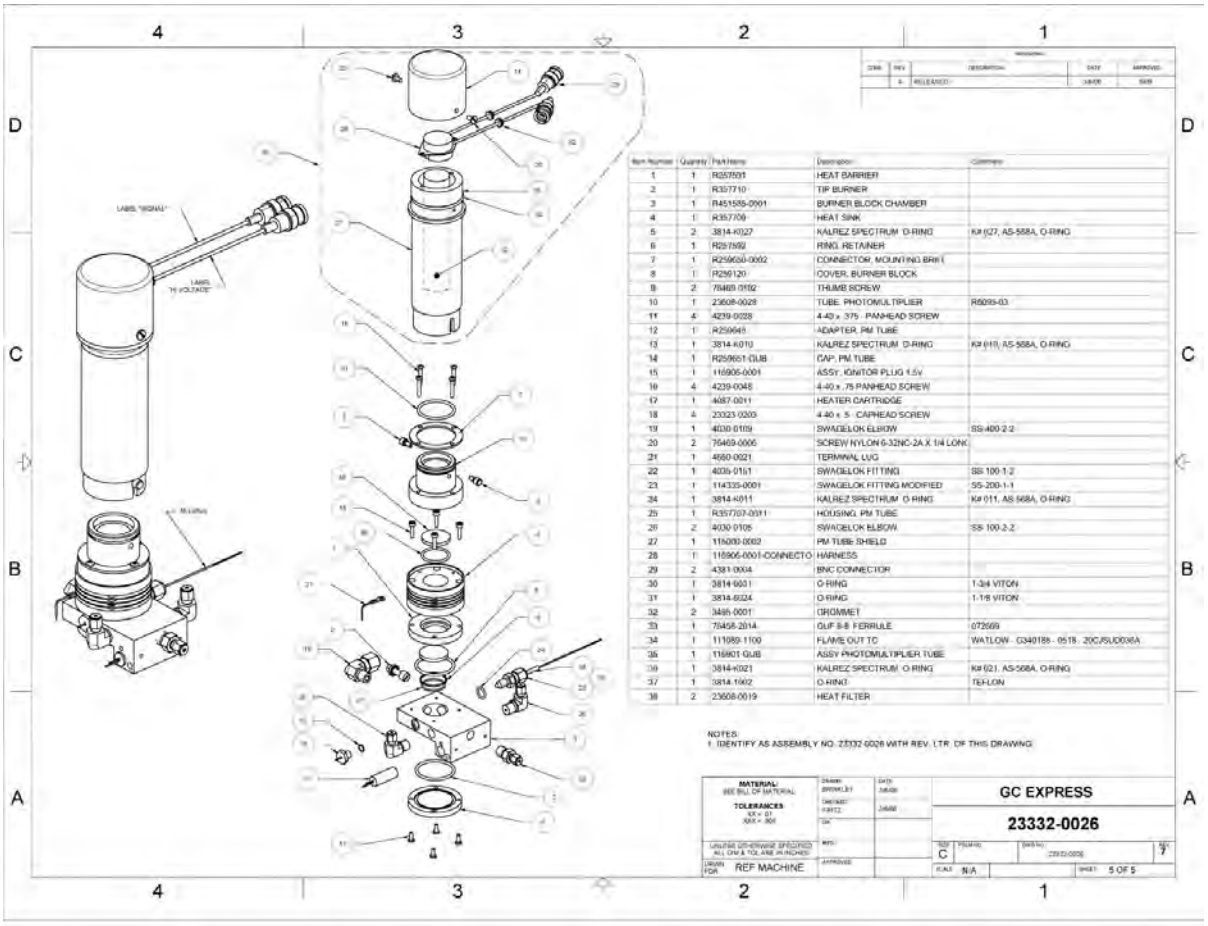
ZONE	REV	DESCRIPTION	DATE	APPROVED



SIZE	FSCM NO.	DWG NO.	REV
B		PL118500-3411-GUB	7

SCALE N/A SHEET 2 OF 6





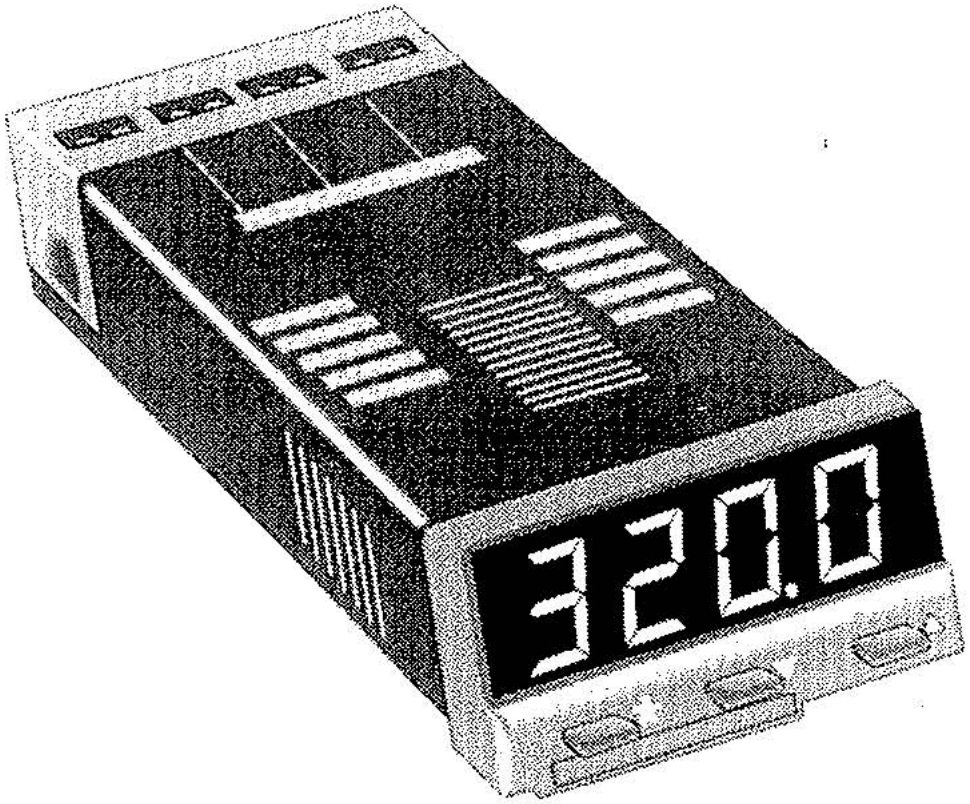
Item Number	Quantity	Part Name	Description	Comments
1	1	R257591	HEAT BARRIER	
2	1	R357710	TIP BURNER	
3	1	R451585-0001	BURNER BLOCK CHAMBER	
4	1	R357709	HEAT SINK	
5	2	3814-K027	KALREZ SPECTRUM O-RING	K# (27, AS-568A, O-RING
6	1	R257592	RING, RETAINER	
7	1	R259620-0002	CONNECTOR, MOUNTING BRKT	
8	1	R259120	COVER, BURNER BLOCK	
9	2	76469-0102	THUMB SCREW	
10	1	23608-0028	TUBE, PHOTOMULTIPLIER	R5093-03
11	4	4239-0028	4-40 x .375 - PANHEAD SCREW	
12	1	R259648	ADAPTER, PM TUBE	
13	1	3814-K010	KALREZ SPECTRUM O-RING	K# (10, AS-568A, O-RING
14	1	R259651-GUB	CAP, PM TUBE	
15	1	116905-0001	ASSY, IGNITOR PLUG 1.5v	
16	4	4239-0048	4-40 x .75 PANHEAD SCREW	
17	1	4087-0011	HEATER CARTRIDGE	
18	4	23023-0203	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	4030-0161	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	116000-0002	PM TUBE SHIELD	
28	1	116906-0001-CONNECTO	HARNESS	
29	2	4381-0004	BNC CONNECTOR	
30	1	3814-0031	O-RING	1-3/4 VITON
31	1	3814-0024	O-RING	1-1/8 VITON
32	2	3495-0001	GROMMET	
33	1	70458-2014	GUF 8-8 FERRULE	072669
34	1	111089-1100	FLAME OUT TC	WATLOW - G340188 - 0518 - 20C/SUC036A
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	

APPENDIX D

PID CONTROLLER MANUAL

CE

User's Guide



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CN132
Temperature/Process Controller

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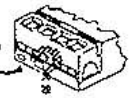
CN132
AUTOTUNE TEMPERATURE CONTROLLER OPERATOR'S MANUAL

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

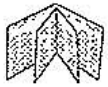
1.  **SCAN** the table of contents and look through the manual. Note sections of interest.

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.

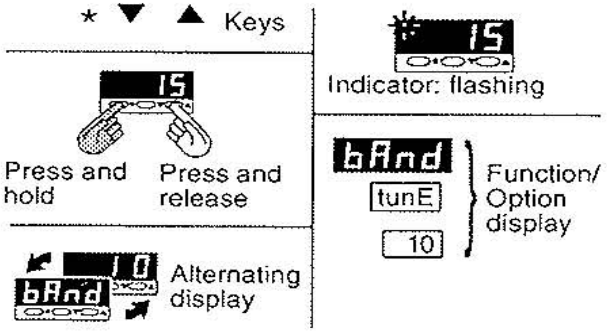
NOTE: The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

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:



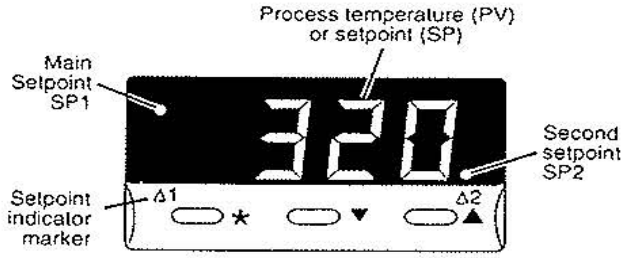
IN BRIEF . . .

Routine adjustments:

- * View setpoint
- * ▲ Increase setpoint
- * ▼ Decrease setpoint

To reset alarm or fault message:

- ▼ ▲ Momentarily press together



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:

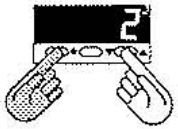
View Function/Option.

Autotune Option value.

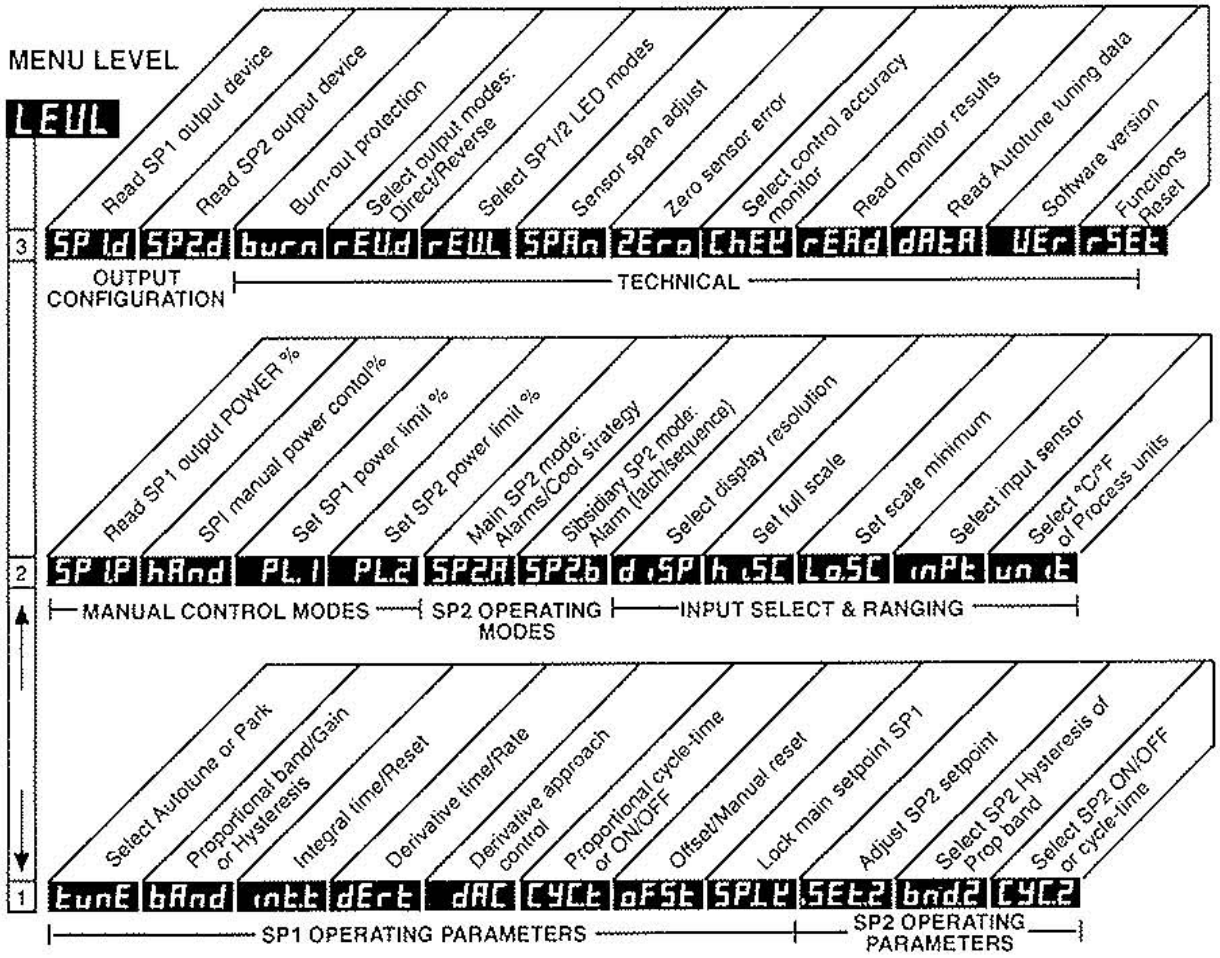
Change Option value (or press ✱ ▼). Release: check for correct selection.

4. Changing menu levels:

Locate level Function.



Select new level.



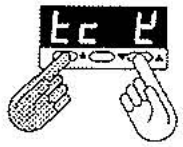
SECTION 3 QUICK SETUP INSTRUCTIONS

For full instructions, see Section 6.

1. **Power up.**

Alternating display after self-test

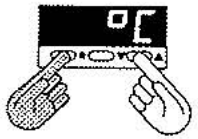
2. **Select input sensor.**



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

3. **Select °C/°F.**

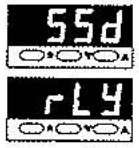
Press once...



...to select.

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

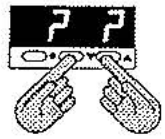
See Section 5.3.
Press once.



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.**

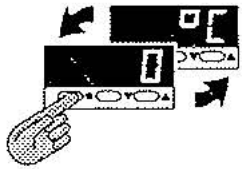
Hold both for 3 sec.

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:**



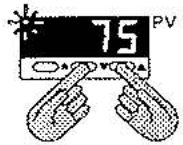
Display setpoint.

To increase setpoint...

To decrease setpoint...

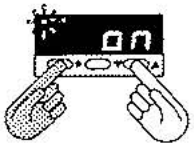
Operational with factory PID settings.

8. **To Autotune:**

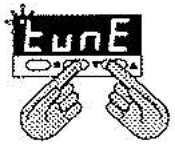


Enter program mode.
Hold both for 3 sec.

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

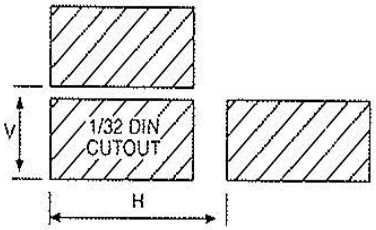
1. Prepare a 1/32 DIN panel cutout:
   45.0mm +0.6/-0 x 22.2mm + 0.3/-0
   1.77″ +0.02/-0 x 0.87″ +0.01/-0
2. Unplug connector now if wiring separately.
   Unlock connector by sliding the green lock outward as shown in 4.2
3. Slide the controller into the cutout.
4. Slide the panel clamp on to the controller 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

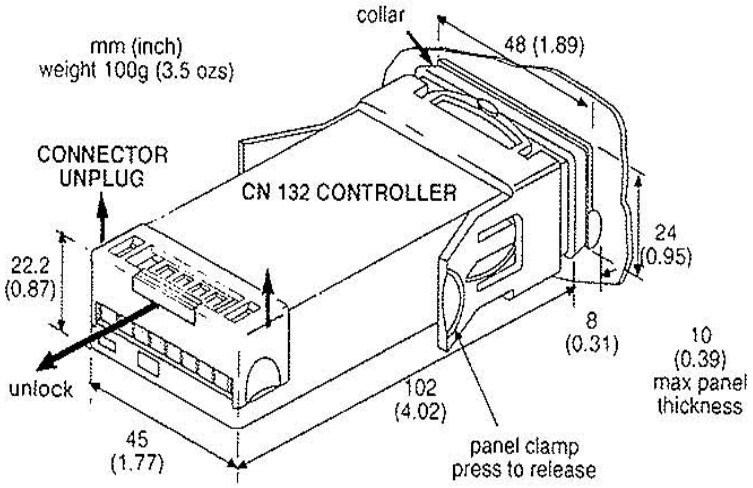
4.2 MULTIPLE CN132 INSTALLATIONS



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)

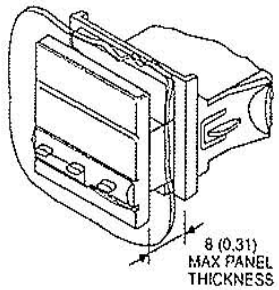
*Recommended



4.3 OPTIONAL 1/16 DIN PANEL ADAPTERS

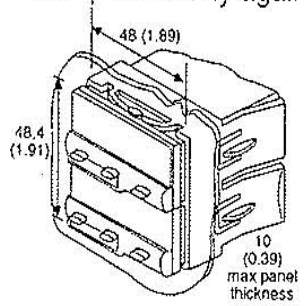
Adapter 48 mm (1.89 in) square enables CN132(s) to be mounted in a 1/16 DIN cutout.

- **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.

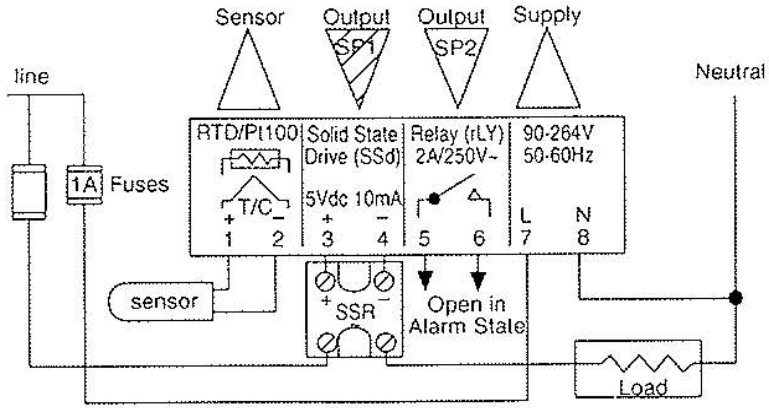
5. **Switching inductive loads with the relay:**

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.

Example A

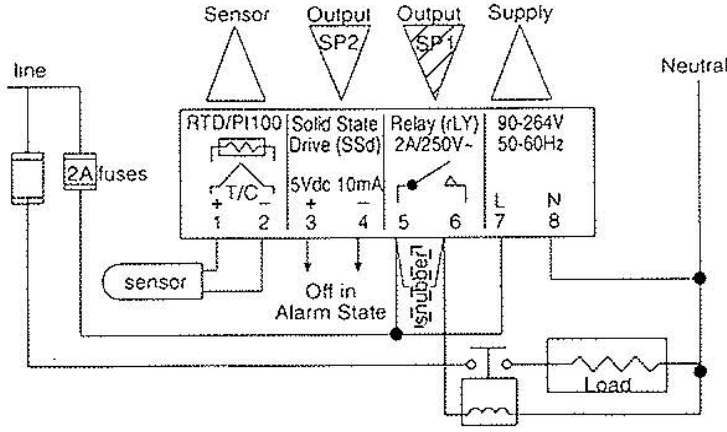
The SSd output is allocated to SP1 and wired to switch the load (heater) using an SSR.



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

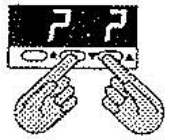
6.1 OVERVIEW

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 set-point 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.

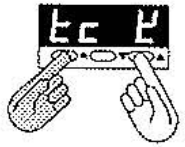
6.2 INITIAL CONFIGURATION

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.

Thermocouples

sensor type	mnemonic	sensor type	mnemonic
B	tcb	N	tcn
E	tcE	R	tcr
J	tcJ	S	tcS
K	tcK	T	tct
L	tcL		

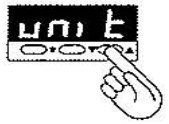
Resistance Thermometer

RTD-2	
Pt100	rtd

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

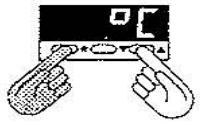
After selection, release ✱. Check that the selection is correct.

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.

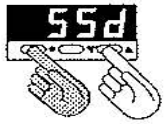
The display shows that no output device has been allocated to SPI.

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.**

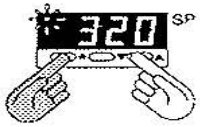
Press and hold both ▼ and ▲ for 3 sec (display may differ).

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.

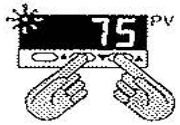
Controller is operational with factory PID settings:

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.**

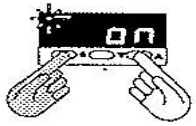


Press and hold both ▼ ▲ for 3 sec.

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 ✱

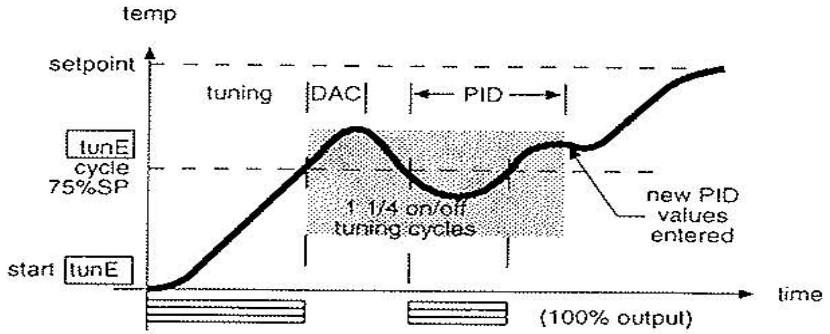
4. **Start TUNE program.**

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

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.

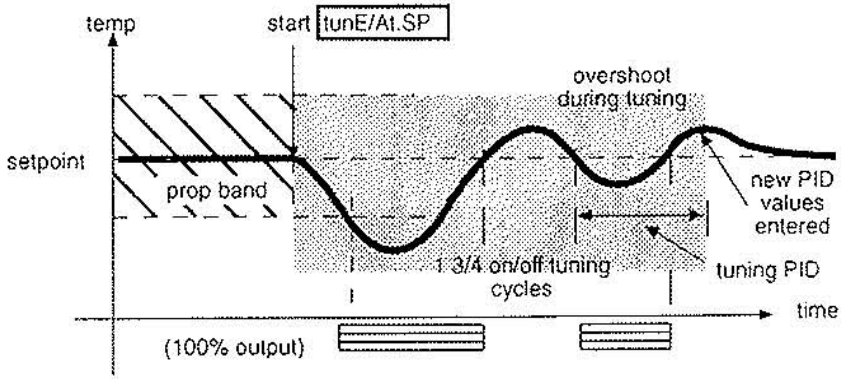
- **The Autotune - TUNE AT SETPOINT program**

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:**

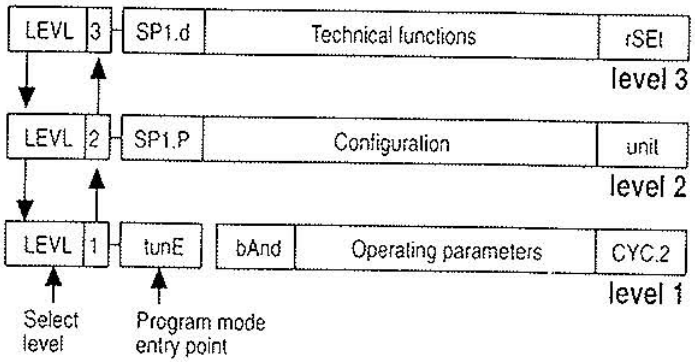
Control with existing settings is maintained during programming. Control with new instructions begins only on exiting program mode, when the controller memory is updated.

- **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] °

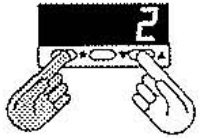
Press ▲ to increase/▼ to decrease, e.g., [bAnd] increased to [15] °. Release ✱

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,

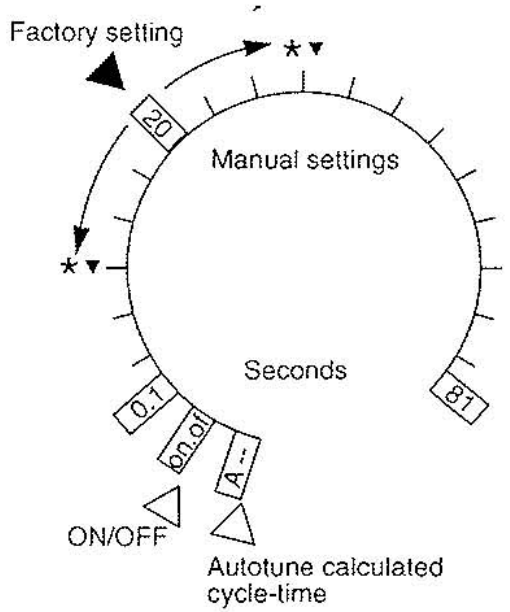
     Or...
   - Select nearest suitable value (20 sec factory setting applies unless replaced)
2. Pre-select automatic acceptance of any calculated Autotune cycle-time. See Section 9.5.
3. Manually pre-select any cycle-time between 0.1 and 81 sec. This will not be changed. See Section 9.6.
4. To use the 20 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

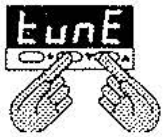
To avoid premature relay failure:

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 drive [SSd]	1–3 sec	SSR
	0.1 sec	Logic/PIM

9.4 TO SELECT AUTOTUNE CALCULATED CYCLE-TIME:

On completion of Autotune:

1. **Enter program mode.**



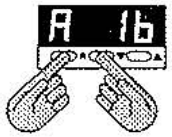
Press and hold both ▼ ▲ for 3 sec.

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

Press and hold ▲

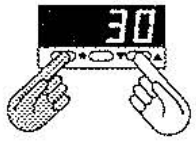
Release ▲; 20 sec factory setting is displayed.

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.**

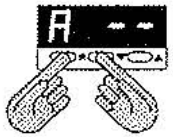
Press and hold both ▼ ▲ for 3 sec to exit program mode and implement the new instructions.

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

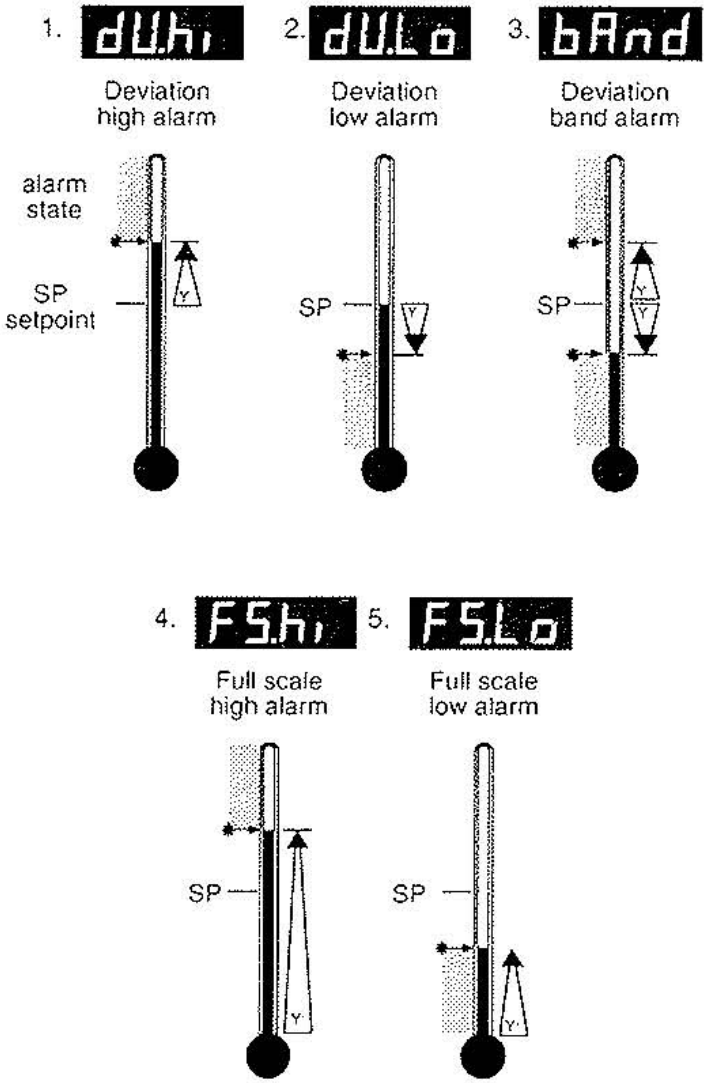
Cool strategy Options:

CooL in SP2.A (Selects cool strategy)

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

10.4 SP2A 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**

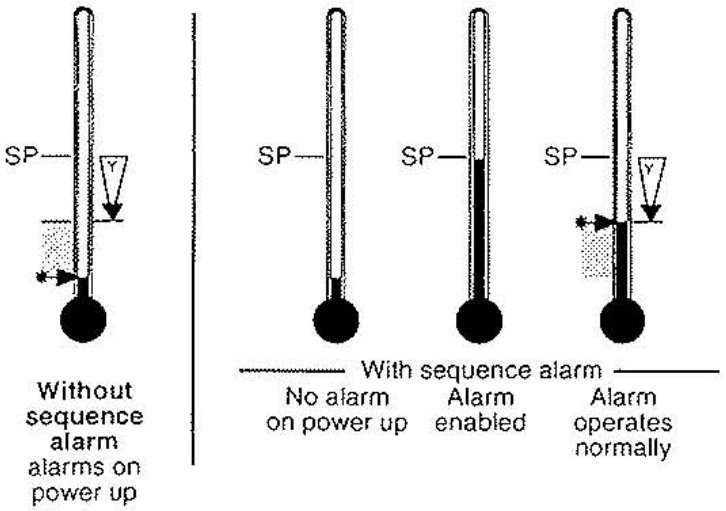
1. LAtch Latch alarm

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

2. hoLd Sequence alarm

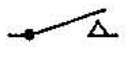
When selected, in any alarm mode, prevents an alarm on power up. The alarm is enabled only when the process temperature reaches setpoint.

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		PROPORTIONAL OPERATING MODE	
	SP2 Output state	SP2 LED state	SP2 Output state	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

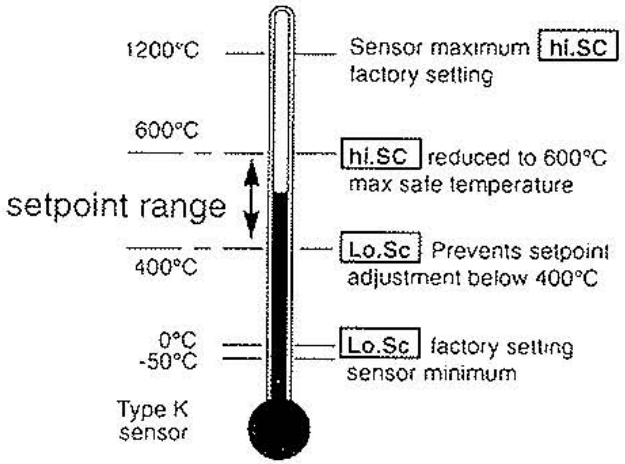
SECTION 11 RANGING AND SETPOINT LOCK

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.

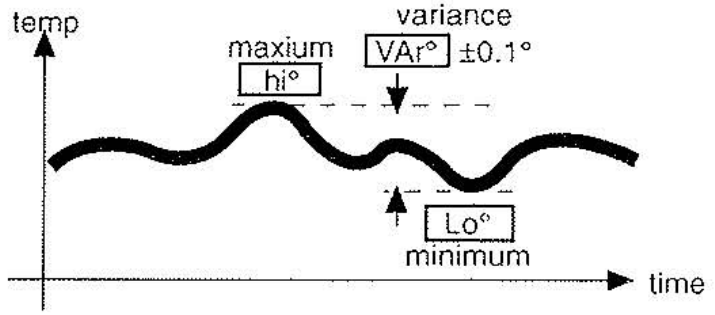
SP1.P constantly displays the output percentage power applied, which at normal setpoint should be within 10–80% (preferably 20–70%) to achieve accurate control.

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:



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.

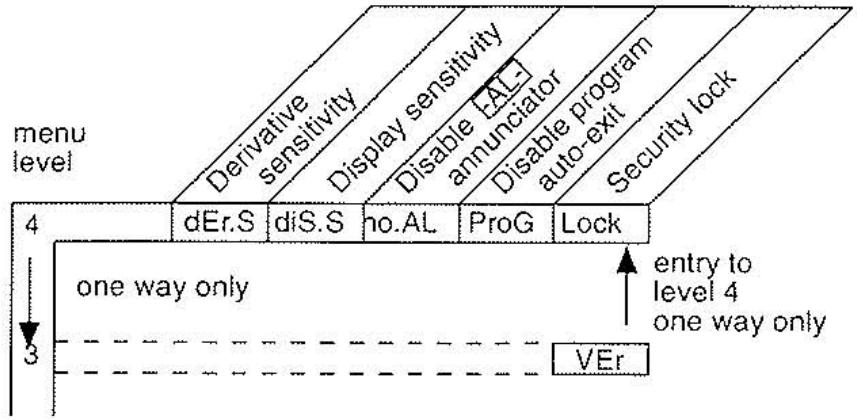
Locks levels 2 and 3 only - CONFIGURATION AND TECHNICAL FUNCTIONS.

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.SS [dir] [1] - [32] [6]
Display sensitivity
[dir] = Direct display of input
[1] = Maximum [32] = Minimum sensitivity

14.3 noAL [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.

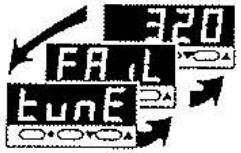
2. **Non-volatile memory error:**

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:

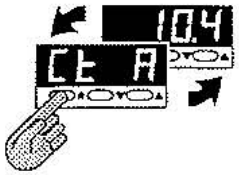
1. Change the conditions, e.g., raise setpoint.
2. Try [tunE] [At.SP]. See Section 7.2.3.
3. Check [SP1.P] percentage power. See Section 12.1.
4. If the error message persists, call OMEGA for advice.

6. Reading Autotune tuning cycle results in [dAtA]

Action:

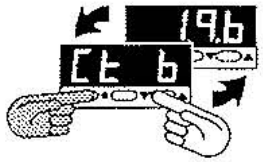
1. Index to [dAtA]

   Release ▼ or ▲



2. Press and hold ✱

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



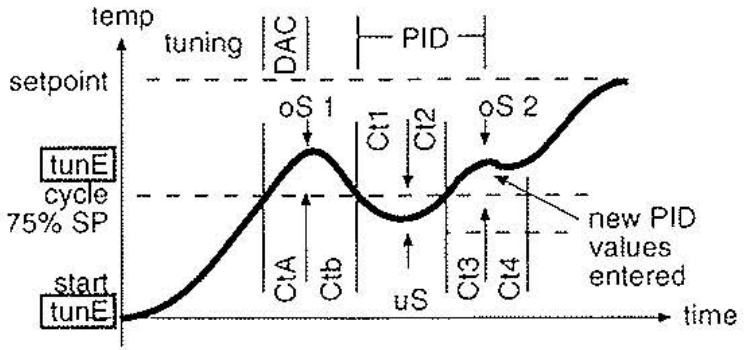
3. Keep ✱ pressed.

   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) } max 255°C/490°F
uS (Undershoot) }

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.

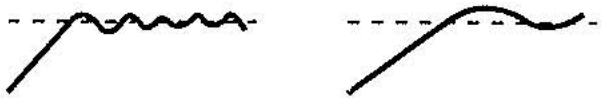
SP1 OPERATING PARAMETERS

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 proportioning 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 **SPLH** [oFF] [on]

Lock main setpoint, see Section 11.2.

SP2 OPERATING PARAMETERS

16.1.9 SE.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 bnd2 [0.1] - [*] °C/°F [2.0°C/3.6°F]

Select SP2 hysteresis or Proportional band/Gain

* 25% sensor maximum

16.1.11 Cyc2 [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 SP.1P [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)

SP2 OPERATING MODES: See Section 10.

16.2.5 SP2A **Main SP2 operating mode**

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

16.2.6 SP2b [nonE] [LtCh] [hoLd] [Lt.ho] [nLin]

Subsidiary SP2 mode: latch/sequence

Non-linear cool proportional band

INPUT SELECTION AND RANGING

16.2.7 d.SP [1] [0.1]°

Select display resolution:

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

16.2.8 h.SC [sensor minimum] [sensor maximum] °C/°F

Set full scale. See Section11.1.

16.2.9 Lo.SC [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 **SP2d** 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 **rEUd** **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 **rELL** 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 **dALA** 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.

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APPENDIX E

SPARE PARTS LIST

PART NUMBER	DESCRIPTION
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 (H2 OR AIR)
59551 2097	HEATER (FLAME CELL & 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 & DETECTOR
116906-0001	IGNITOR WITH KALREZ O-RING
23608-0019	HEAT FILTER
23608-0027	OPTICAL FILTER

For price & delivery information please contact your local Emerson Sales office, or email sales.gcema@emersonprocess.com

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

APPENDIX F

TEST PROCEDURES

1. FPD FLAME LIGHTING PROCEDURE

APPENDIX F1 Flame Lighting Procedure

Connect Air to the inlet and slowly bring the inlet pressure to 60 psig.
Connect Hydrogen to the inlet and slowly bring the inlet pressure to 60 psig.

Remove tubing from flame cell exhaust and using a Digital Flow Meter, adjust the Air control valve until a reading of 160cc/min is obtained.

Turn off the Air supply.

Set the Auto relight switch (S1) on the Electrometer PCB to the OVER-RIDE position.

Using the Digital Flow Meter, adjust the Hydrogen control valve until a reading of 100cc/min is obtained.

Turn on the Air supply.

Set the Auto relight switch (S1) on the Electrometer PCB to the RUN position.

The Auto relight sequence will now commence as follows.

The LED on the Electrometer will come on after 10 seconds and the Glow plug fitted to the side of the flame cell will now be supplied a voltage.

After another 5 seconds the Hydrogen shut off valve will operate.

The gas mixture should be ignited.

If the flame does not light, in 5 seconds, the Electrometer will de-energise the Hydrogen shut off valve to stop the flow into the flame cell.

The flame cell is then purged with Air and Nitrogen carrier.

The process will start again (Up to 10 times) until the flame stays lit.

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

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 will be restarted.

If the unit still fails to light after resetting the Electrometer. The Air and Hydrogen flows should be rechecked.

The Electrometer Flame Out Alarm.

The flame out alarm occurs only when the Electrometer has tried, unsuccessfully, to ignite the flame. This is when the auto re-light circuit has run through its sequence ten times.

The alarm contacts are available between connector 2 pin 1 or 4 (common) and connector 3 pin 1 (alarm signal). The reading across these pins is open circuit, when no alarm is present and less than 20 ohms in the alarm condition.