Model DT3000
O_2 Oxygen Analyzer

This Manual Covers The Following systems:

Panel Mount
Rack Mount
Insitu
Extractive

Version 1.17

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Introduction

This manual contains instructions for the operation and programming of a DT3000 Oxygen analyzer.

This analyzer has two basic designs:

Insitu System – This refers to an installation where the probe for collecting the gas sample has the Oxygen sensor (O_2 Head) as an integral part of the probe. This is typically used on a positive or neutral (where an eductor is added) pressure stack or duct and the sample is forced through the sample line to the control unit.

Extractive System – This refers to an installation where the probe for collecting the gas sample is separate from the Oxygen sensor. This is typically used on a negative pressure stack or duct where the sample is drawn through the sample line by a vacuum pump.

In addition to the different designs, there are different control configurations:

Panel Mount Control – This configuration houses the control system only and is typically used with the Insitu design. However it could be used where the extractive Oxygen sensor and probe are remotely located.

NEMA 4 Control - This configuration houses the control system only in a NEMA 4 rated wall mount cabinet, and is typically used with the Insitu design. However it could be used where the extractive Oxygen sensor and probe are remotely located.

Rack Mount Control - This configuration houses the control system and the Oxygen sensor (O_2 Head) on a 19” rack mount panel, and is typically used with the Extractive design. The pump is located elsewhere.

Self Contained Control – The self contained control is an Extractive system where the control, vacuum pump and Oxygen sensor are all located in a single NEMA 4 wall mount cabinet.

Drawings of these various configurations are located in the Appendix of this manual.

Special Note for Insitu Systems

The Insitu DT3000 is based on gas be presented to the Oxygen sensor (O_2 Head) sensor. There may be circumstances that exist where the gas to be measured does not reach the sensor (in a neutral pressure duct, for instance). For those circumstances a stainless steel eductor (see drawing DT3000-07) has been supplied with your DT3000 system.

An eductor is a device that produces suction when air is introduced into it. This suction draws the flue gas up the probe and insures it presentation to the sensor.

If the system calibrates properly but the O_2 reading from the gas being monitored drifts aimlessly in the higher percentile range, install the eductor in the system.

Section 2 of the manual has air pressure versus sample flow rates for correct flow adjustment.

Plant air can be used to feed the eductor but instrument grade air is recommended for maintenance free operation of the eductor.

SECTION 1

ANALYZER OVERVIEW

1.1 Configurations covered by this manual

Insitu
Extractive
Panel Mount
NEMA 4 Mount
Rack Mount

1.2 Analyzer Description

The Datatest Model DT3000 Oxygen Analyzer is designed for continuous measurement of Oxygen concentration in a non-combustible or low-level combustible flowing gas sample. The Model DT3000 reflects the state of the art in detector and electronic hardware design. For extractive O_2 systems using a sampling system (user provided), sample gas is piped to a Zirconia sensor mounted in the O2 Head. The O2 Head can either be mounted in the analyzer unit (Controller), or remotely mounted. For Insitu O_2 systems, the sensor is located directly on the probe in the stack or duct.

The electronic package incorporated within the DT3000 features microprocessor technology that greatly expands the versatility and capabilities of the Oxygen Analyzer.

The display prompts the operator during the set-up routines, shows instant and average concentration of sample, high and low alarm set points, recorder range, and more. A standard Modbus RTU (RS232, or 485, or 422) communication port is also provided to allow two-way communication with data acquisition systems.

The 16-key keypad provides a completely sealed keyboard to assure that its touch-sensitive contacts are not subject to dust or moisture.

1.3 Theory of Operation

The measurement of oxygen is accomplished by reading voltage developed across a heated Zirconia cell that is induced by uneven concentrations of oxygen. The O_2 sensor consists of a Zirconia Cell, which is coated with porous metal electrodes. The sample gas is supplied to the sample side of the cell by an external source and reference air (ambient air) is provided to the opposite side of the cell.

Electronic temperature control maintains proper cell temperature.

For best results, supply the analyzer with clean, dry, instrument air (20.95% oxygen) as a reference gas. With the sensor at its operating temperature, and unequal oxygen concentrations across the cell, oxygen ions travel from high partial pressure side to low partial pressure side. This characteristic enables the oxygen analyzer to provide exceptional sensitivity at low oxygen concentration.

WARNING

Do not use this analyzer on flammable samples, use explosion-proof version for analysis of flammable samples. If used for analysis of explosive gases, internal leakage of sample could result in explosion causing death, personal injury, or property damage.

The DT3000 Oxygen Analyzer measures net oxygen concentration in the presence of all products of combustion, including water vapor. There the analysis is made on a 'wet' gas basis.

1.4 Electronic Controller

The DT3000 microprocessor controller electronically controls sensor temperature, heater power, display measurements, functions, and provides isolated analog outputs that are proportional to measured oxygen concentrations. Normally open (N.O.) relay contacts are provided for low and high alarm set points, zero, span calibration, back purge, and system fault.

Temperature of the oxygen cell is maintained constant by modulating the duty cycle of the sensor's heater. The electronics accepts millivolt signal generated by the sensing cell and converts this voltage signal to an analog isolated 4-20mA current output to be used by remotely connected recording devices.

1.5 Standard Analyzer Features

1. Recalibration through a 16-key tactile feedback membrane keyboard.

2. Prompts on a 4-line by 20-character LCD display help an operator during the various set-up routines (such as for concentration of sample, average concentration, alarms levels, etc.).

3. Standard RS-232/485/422 ports (unit ships in RS232 configuration) to allow bi-directional communication with other data acquisition systems.

4. Completely sealed keyboard for reliable long term operation.

5. Alarm indications of fault conditions with independent set points alarms.

6. Standard isolated current (4-20mA) outputs.

7. Continuous monitoring of the sensor’s condition.

SECTION 2

SPECIFICATIONS

2.1 ANALYZER

Standard Measurement Ranges	Measures O2 from 0-25% adjustable
Analog Outputs	Standard 4-20 mA
Analyzer Method	Insitu and Extractive
Detector Type	Zirconia
Accuracy	Linear: 0-10% +/- 0.1% F.S.
	0-25% +/- 0.25% F.S.
Response Time	5 seconds (95%) step input at inlet
Sensitivity	0.1% (25% Scale) F.S.
Display	4-Line by 20 Character Backlit LCD
Supply Voltage	115/220 VAC +/- 10% at 50/60 Hz.
	Ships standard at 115 volts
Power Consumption	100 Watts at 115 VAC, 50/60 Hz.
Enclosure	19" Rack Mount or NEMA 4 Wall Mount or Panel Mount (standard)
Alarm Set Points	0-25% O_2 user selectable

2.2 DETECTOR

Type	Zirconia
Temperature	1000°F. Controlled by microprocessor with readout on LCD Display

2.3 SAMPLE

Sampling Rate Extractive System	Approximately 5.0 SCFH (473 cc/min)…. Note. For Extraction using and eductor: Assuming sample and air lines are ¼' tube: Air Pressure of 5/10/15 Psi will pull a sample of 3.5/7/10 SCFH
Sampling Rate Insitu System	Should the probe be situated in an area where the pressure at the sensor is inadequate, The use of an eductor, supplied as standard with your Datatest Probe will allow you to overcome this negative pressure and pull the gas from the stream, up the probe, and allow it to be presented to the sensor. **The vent hole at the top of the probe must remain plugged when using an eductor.** Some guidelines for eduction are as follows: Assuming air lines are ¼' tube, air Pressure of 5/8/10/12 psi will pull a sample of 3/5/5.5/7 SCFH
Response Time	95% of full scale within 5 seconds
OUTPUTS	
LCD Display	4-line by 20 character LCD
Analog	4-20mA
Serial Ports	RS-232/459/422 to a computer for bi-directional communication. RS232 ships as standard
Relay Outputs (N.O. SPST, 1A)	System alarm, Back Purge, O_2 low, O_2 high, Zero, and Span

2.4 CALIBRATION

External	Standard calibration procedure permits the introduction of zero and span gases through the sample port.
Cal Gas Target Values	Standard zero and span values entered via keypad.
Frequency	Via external digital (potential free) inputs
Recommended Calibration Gas Mixture	Zero: 2% O_2, Balance N_2; Span: 8% O_2, Balance N_2
Recommended Calibration Gas Flow Rate	5.0 SCFH (473 cc/min)

2.5 ALARM

Concentration	0-25%, user selectable
System	Denotes a system failure.
Internal	Audible 60 dB alarm
External	N.O. SPST Relay Contacts, 10 Amp AC/DC
Alarm Condition	Reported to screen, and communications output port.

2.6 GASES

Reference Air	No more than 1 SCFH at .1 psig required.
Ports	1/4" tubing connections

2.7 SAMPLE PROBES

Probe Material / Gas Temperature	316 Stainless Steel or Inconel. Standard: 1,500°F (815°C) max. Alumina (High Temp) - Optional 2,800°F (1538 °C) max
Probe Length	Standard: 2 feet. Optional: up to 9 feet.
Flange	Stainless steel 304, ANSI #125, Insitu: 4”

SECTION 3

INSTALLATION

3-1 OVERVIEW:

This section covers the installation of the Model DT3000 Oxygen Analyzer. When installing, observe the following precautions.

a. Do not operate this analyzer in an explosive atmosphere.

b. The control unit mounting location must be dry and not exposed to freezing temperatures. Formation of condensation must be avoided. Do not place the control cabinet in direct sunlight.

c. Ambient temperatures must be between 32°F and 112°F (0°C and 45°C). If the analyzer is used outside its operating range, accuracy and error limit cannot be guaranteed.

d. Eliminate vibrations. Structural vibrations, machinery vibrations, etc. will affect the operation and life of the analyzer. Find a vibration free structural wall or a similar place for firm mounting of the controller.

e. If the unit is to be extractive, mount the analyzer as close to the sampling point as possible. This will reduce dead time. If a suitable installation place cannot be found close enough, the dead time due to longer lines can be made up by a higher sampling delivery rate.

f. All wiring must be in accordance with national and local wiring codes.

3.2 INSTALLATION

Mechanical Installation

The O_2 Analyzer control unit requires installation in a location where the temperature range is between 32°F and 112°F (0-45°C).

Electrical Connections: See Appendix for drawings.

1. Power input: 115 or 220 VAC, +/-10%, single phase, 50 or 60 Hz, 250 watts maximum.

2. The power cable should comply with the safety regulations in the user's country and should never be smaller than 12 AWG (14 SWG).

3. ANALOG SIGNALS: The Model DT3000 has standard 4-20mA current outputs. The current outputs are calibrated for a 250-ohm load. This output signal can be fed to an external load such as a recorder, or the signal can be used to drive a single external meter or recorder, as desired.

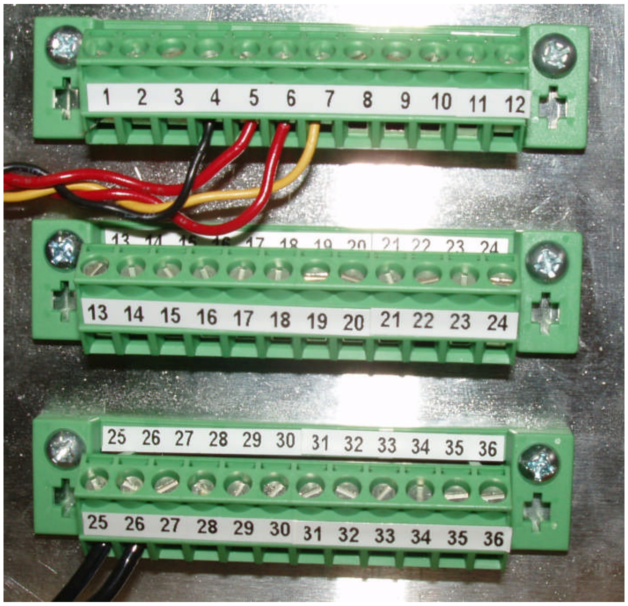
4. RS-232/422/485 CONNECTIONS: The Model DT3000 is equipped with a serial port that can be configured for RS-232 or RS-422 or RS-485. This allows the Model DT3000 to report its data to a DCS or other computer via a Serial Modbus RTU Protocol.

5. DIGITAL INPUTS: There are several digital inputs on the Model DT3000. These inputs permit external devices to initiate zero and span checks. A will initiate a zero calibration and a 120 Vac input to TB1/2 will initiate the span.

6. RELAY OUTPUTS: Several relay outputs are available on the rear panel TB1, terminal strip. They are:

TB1	**DESCRIPTION**
10	System Fault
11	System Fault
12	Back Purge
13	Back Purge
14	O_2 Low Alarm
15	O_2 Low Alarm
16	O_2High Alarm
17	O_2 High Alarm
18	Zero Cal Solenoid Valve
19	Zero Cal Solenoid Valve
20	Span Cal Solenoid Valve
21	Span Cal Solenoid Valve

TB1 Layout on back of Control



3.3 PNEUMATIC CONNECTIONS

The following gases are needed to accurately operate the Model DT3000**.**

1. Zero Gas with cylinder regulator capable of being set to approximately 2-5 psig. Consumption will be approximately about 5.0 SCFH. This gas is connected to the Cal Port of the insitu probe using 1/4" tubing. The zero point O_2 concentration should be approximately 1 to 2% O_2.

2. Span Gas with cylinder regulator capable of being set to approximately 2-5 psig. Consumption will be approximately about 5.0 SCFH. This gas is connected to the Cal Port of the insitu probe using 1/4" tubing. The zero point O_2 concentration should be approximately 8.0% to 14.0% O_2.

3. Since the sensor operates with respect to a reference air, there may be occasions where the ambient air on the atmospheric side of the cell needs supplemental air. Connect this via a regulator capable of being set to 1 psig. Consumption will be approximately 1.0 CFH. This is connected to the insitu probe air reference port.

4. Back purge air should be connected via a Back Purge solenoid. This requires a line or tee from the exit port of the solenoid into the Back Purge port of the O_2 insitu probe (see drawing DT3000-07). Connect the back purge air via a regulator capable of being set to 40 psig. Assuming air lines are ¼' tube, air Pressure of 5/8/10/12 psi will

pull a sample of 3/5/5.5/7 SCFH. This is connected to the insitu probe purge air port.

When the back purge solenoid is activated there is an immediate blast of pressurized air which flushes or back flushes the O_2 insitu sample probe filter. In order for a pressurized blast of air to hit the probe filter the connecting lines to the solenoid should be as short as possible to avoid restriction.

SECTION 4

PARAMETERS DEFINITIONS

4.1 INTRODUCTION

This section goes through each of the parameters that are needed by the Model DT3000 for operation. The discussion here will detail the full features and limits of these parameters. The order of presentation will be the same here as the order they appear in the parameter routine.

4.2 BACK PURGE PERIOD

This parameter determines the period of time between back purges of the sample probe filter. The back purge period is entered here in hours. The higher the particulate concentration in the flue gas the more often the filter should be cleaned, and the shorter this time must be. Back purge is inhibited during a calibration period.

4.3 BACK PURGE DURATION

The duration of the back purge is set in seconds and is the time that the blow back solenoid is activated and there is back flow across the filter. In practice it is generally the initial blast of high-pressure gas that dislodges the particulates in the filter. Therefore this time can be set quite low (ex. 10 sec).

4.4 ROLLING AVERAGE

The Rolling Average is used to set the time frame for the O_2 reading rolling average that is reported to the authorities. The rolling average is the number displayed on the Run Screen next to Avg.

4.5 INSTANT AVERAGE

The instant average is the block of time that an O_2 reading is averaged over. It is different from a rolling average in that the time frame is discrete and the value is discarded at the end of the period. This instant average is used primarily for trim control.

4.6 RECORDER RANGE

The recorder range relates to the analog signal available at the recorder terminals on the rear of the Model DT3000. This analog signal is obtained from the digital output and is thus a calibrated signal directly proportional to the instantaneous concentration the Model DT3000 detector is seeing. This signal is 4-20 mA. The full-scale value for 20mA is set by the Recorder Range parameter.

4.7 O2 LOW ALARM SETPOINT

A Low O_2 concentration alarm is set to provide relay contacts and alarm messages for a low O_2 condition. If the concentration goes below the low set point value, two things happen.

1. The display shows the statement 'LOW O_2 ALARM' at the bottom of the run display.

2. The low concentration alarm terminals on the rear of the Model DT3000 will have a contact closure between them.

When the concentration rises above the low set point the relay closure opens and the alarm on the display is removed.

4.8 HIGH ALARM SETPOINT

A High O_2 concentration alarm is set to provide relay contacts and alarm messages for a high O_2 condition. If the concentration goes above the high set point value, two things happen.

1. The display shows the statement 'HIGH O_2 ALARM' at the bottom of the run display.

2. The high concentration alarm terminals on the rear of the Model DT3000 will have a contact closure between them.

When the concentration falls below the high set point the relay closure opens and the alarm on the display is removed.

The display indication of an alarm condition alerts the operator to check the alarm status menu.

4.9 CAL PURGE TIME

The Cal Purge Time is used in the various methods for calibration. It is set in seconds in the parameter routine but in practice it counts down in seconds. This allows sufficient time for the various gases to flush the sample lines and O_2 cell prior to taking any concentration readings.

4.10 SAMPLE & HOLD IN CAL

The sample and hold in cal is used when the DT3000 is being used for trim control and the calibration cycle could cause a boiler upset. When an auto calibration cycle is initiated the last O_2 reading on the 4-20ma output. This is held until the calibration cycle is complete.

4.11 AUTO CALIBRATION

This function allows for an automatic calibration of the instrument on a clock timed basis. This will use relay contacts to open solenoid valves to perform the calibration

4.12 SET TIME HH:MM

The control contains a real time clock that is set in military time. Various routines are automatically initiated based on the time of day. It is important that this time is set accurately.

4.13 COMMS. SETUP

When communicating with a remote device (DCS, PC, PLC, etc.), each O_2 analyzer must have a unique ID number between 0 and 255. The actual ID number assigned can be anywhere in the appropriate range but ID numbers must never be duplicated.

Following a parameter routine, the Model DT3000 returns to the Main Menu. The operator must select the next operation from this menu

SECTION 5

The following programming is performed through the Keypad and Display on the front of the control cabinet. This is shown below.

E
SCRIPTION

5.1 INTRODUCTION

The Utility portion of the Main Menu provides a number of features to the operator as explained below. The Utility Menu is accessed from the Main Menu by pressing 4.

MAIN MENU	
1 - RUN	**4 - UTILITIES**
2 - CALIBRATION	
3 - SET PARAMETERS	

There are four different portions of the Utilities Menu.

1-Signals
2-Output
3-Digital In
4-O2 Clamp

The following is a description of the Utilities and what they mean:

5.2 SIGNALS

Pressing the "1" key displays the Signals screen shown below:

TEMP = 1000.0 **CELL = 18.1**

This is used for diagnostic purposes. It shows the current Zirconia cell temperature and the instantaneous O_2 value. In the above example the Zirconia cell temperature is 1000 degrees Fahrenheit, and the O_2 level is 18.1.

Press the "CLR" key to return to the Utilities Screen.

5.3 OUTPUTS

Pressing the "2" key displays the Outputs screen shown below:

DAC Output = 0%

This is also a diagnostic tool to check the digital output signal from the analyzer. The normal signal output is 4 to 20 ma. When 0% is programmed the output should be 4 ma, when 100% is programmed the output should be 20 ma, and when 50% is programmed the output should be 12 ma.

The opening screen has the Output set to 0%. Pressing the "CLR" key changes the values. The first press will change the value from 0% to 100%, and the second push will change the value from 100% to 50%. The third push will return you to the Utilities Menu.

Press the "CLR" key to return to the Utilities Screen.

5.4 DIGITAL IN

Pressing the "3" key displays the Digital In screen shown below:

Digitals = 1__4__78

This screen will show which digital inputs are presently active. The display may show anywhere from zero to all eight inputs as is applicable at any point in time.

Press the “CLR” key to return to the Utilities Screen.

5.5 O2 CLAMP

Pressing the “4” key displays the Digital In screen shown below:

O2 Clamp
Clamp = 17.50 pct

As the Oxygen in the air increases when a process comes off line, the signal from the Zirconia cell decreases. Eventually the electrical noise level is above the signal level and the readings become unstable.

For that reason we clamp the O_2 to a reasonably high level where we then display 20.95 which is the amount of oxygen is ambient air.

This screen is used to enter this upper level where the readings are no longer reliable. As a default this number is set to 17.5%.

SECTION 6

STARTUP AND OPERATION

6.1 INTRODUCTION

When the Model DT3000 has been set up as described in section 3, it is then ready for operation. This section describes what the Model DT3000 does and what is needed from the operator.

6.2 INITIAL STARTUP

Initially it is suggested that the Model DT3000 be operated with the same parameters that were in the instrument on arrival. Likewise, the same calibration can be used that the instrument received during test. This will insure that there is no problem with the hardware. The following procedure is therefore recommended.

6.3 SET UP PROCEDURE

Start Up

It is suggested that before configuring the instrument for your specific needs you verify its performance. The test parameters from the factory reside in the instrument memory; therefore its performance can be verified. The following procedure will allow you to verify this performance.

1. Turn the power switch to the ON position. The following vanity screen will display for a few seconds.

Datatest Industries **Model 3000** **Oxygen Analyzer**

2. The DT3000 will display the RUN SCREEN as shown below. The bottom line of this screen is reserved for alarm notification, and will be blank under normal operating conditions.

O2 =0.00%
Avg =0.00%
Temp = 0.00°F

3. The instrument will proceed with its warm up and stabilization routines.

4. Connect the calibration gas line to the insitu O_2 sample probe. Set external cylinder gas pressures to 2 psi.

6.4 SETTING PARAMETERS

Pressing "CLR" on the keypad brings up the Main Menu shown below.

MAIN MENU
1 - RUN 4 - UTILITIES
2 - CALIBRATION
3 - SET PARAMETERS

The instrument operating parameters can be set through the Main Menu by pressing the "3" key.

The display now appears as follows.

Back Purge Period

The bottom line is the active parameter. Additional parameters can be accessed by pressing the "↓" key. Each time the "↓" is pressed the display will scroll and show a new parameter on the bottom line. Pressing the "↑" key will reverse the direction of the scroll and allow access to a parameter you may have already past. There are ten (10) parameters that can be accessed and they are:

Back Purge Period
Back Purge Duration
Rolling Average
Instant Average

Recorder Range
O_2 Low Set point
O_2 High Set point
CAL. Purge Time
Sample & Hold in CAL
Auto Calibration
Set Time   HH:MM
Comms. Setup

To edit the **BACK PURGE PERIOD** make sure it is on the bottom line then press the “ENT” key. The following prompt will be displayed:

Back Purge Period
BPP = 012 min

To edit the Back Purge Period (BPP), press the numeric keys that correspond with the desired time and press “ENT” key to accept this value. The programmable range is 0 minutes to 999 minutes.

This is used only for back purging the stack probe filters. Note that it applies only if back purging is to be under control by the Model DT3000 for back purging the insitu sample probe.

A parameter can be changed, as many times as needed, to make sure it is correct. The value retained by the Model DT3000 will be the value present when “ENT” key is pressed (unless the value was out of the acceptable range).

Advance to the next parameter by pressing the “↓” key.

The display scrolls up with the bottom line reading Back Purge Duration:

Back Purge Period
Back Purge Duration

To program the **back purge duration** press the “ENT” key. The following prompt will be displayed:

Set Back Purge Dur

BPD = 10 seconds

The Back Purge Duration is the time in seconds for the back purge duration and should be 0 if a back purge is not desired.

To edit the Back Purge Duration (BPD), press the numeric keys that correspond to the desired time and press "ENT" key to accept this value. The programmable range is 1 second to 60 seconds.

Advance to the next parameter by pressing the "↓" key.

The display scrolls up with the bottom line reading Rolling Average:

Back Purge Period
Back Purge Duration
Rolling Average

To program the **Rolling Average** press the "ENT" key. The following prompt will be displayed.

Rolling Average

AVERAGE = 1 min

The Rolling Average is used to set the rolling average of the O_2 reading that is displayed on the Run Screen next to Avg.

To edit the Rolling Average, press the numeric keys that correspond to the desired minutes. The programmable range is from 1 minute to 240 minutes. Press the "ENT" key to accept this value.

The display scrolls up with the bottom line reading Instant Average.

Back Purge Period
Back Purge Duration
Rolling Average
Instant Average

The **Instant Average** is used to set an average over a block of time. After the first block of time is averaged a second block of time will be averaged. Past data is discarded for averaging purposes. The Instant Average is displayed next to the O_2 on the Run Screen. Instant Average is used more for trim control and Rolling Average is used more for reporting

To program the Instant Average press the "ENT" key. The following prompt will be displayed.

Instant Average

AVERAGE = 5 sec

To edit the Instant Average, press the numeric keys that correspond to the desired seconds. The programmable range is from 1 second to 60 seconds. Press the "ENT" key to accept this value.

Advance to the next parameter by pressing the "↓" key.

The display scrolls up with the bottom line reading Recorder Range:

Back Purge Duration
Rolling Average
Instant Average
Recorder Range

The Recorder Range is from zero to 25 percent full scale in one percent increments of the recorder.

To program the Recorder Range press the "ENT" key. The following prompt will be displayed:

Set Recorder Range

Range = 25 percent

To edit the Recorder Range, press the numeric keys that correspond to the desired percent and press the "ENT" key to accept this value.

Advance to the next parameter by pressing the "↓" key.

The display scrolls up with the bottom line reading O2 Low Setpoint:

Rolling Average
Instant Average
Recorder Range
O2 Low Setpoint

The O_2 Low Set point is used to set the lower end of the O_2 alarm range. If the O_2 falls below the value of the O_2 low set point the analyzer will send an alarm and display an alarm on the bottom line of the Run Screen.

To program the O_2 Low Set point, press the “ENT” key. The following prompt will be displayed.

Set O2 Low Set point

O2 Low = 2.00 pct

To edit the O_2 Low Set point, press the numeric keys that correspond to the desired percent. It is recommended that this alarm be set low enough that it does not trigger during start up. The programmable range is from .1 percent to 25 percent. Press the “ENT” key to accept this value.

Advance to the next parameter by pressing the “↓” key.

The display scrolls up with the bottom line reading O_2 High Set point.

Instant Average
Recorder Range
O2 Low Set point
O2 High Set point

The O_2 High Set point is used to set the lower end of the O_2 alarm range. If the O_2 exceeds the value of the O_2 High set point the analyzer will send an alarm and display an alarm on the bottom line of the Run Screen.

To program the O_2 High Set point, press the “ENT” key. The following prompt will be displayed.

Set O2 High Set point

O2 High = 15.00 pct

To edit the O_2 High Set point, press the numeric keys that correspond to the desired percent. The programmable range is from .1 percent to 25 percent. Press the “ENT” key to accept this value.

Advance to the next parameter by pressing the “↓” key.

The display scrolls up with the bottom line reading Cal Purge Time:

Recorder Range **O2 Low Set point** **O2 High Set point** **Cal Purge Time**

Cal Purge Time is used when in calibration to allow sufficient time for the calibration gases to flush the sample lines and the detector prior to taking a reading. It is entered in seconds. This parameter should be 00 if CAL PERIOD = 00.

To edit Cal Purge Time press the “ENT” key. The following prompt will be displayed.

Set CAL Purge Time **CPT = 60 sec.**

To edit the CAL Purge Time, press the numeric keys that correspond to the desired seconds and press the “ENT” key to accept this value. The programmable range is from 1 second to 600 seconds.

Advance to the next parameter by pressing the “↓” key.

The display scrolls up with the bottom line reading Sample & Hold in CAL.

O2 Low Set point **O2 High Set point** **Cal Purge Time** **Sample & Hold in CAL**

The Sample & Hold in CAL is used to ensure that if you are using the unit for **TRIM CONTROL,** the analog outputs will lock at the last measured O_2 values prior to the cal procedure being invoked. This will prevent the boiler control instrument from being upset by the swings in O_2 from Zero to Span as the instrument executes its cal cycle.

To program the Sample & Hold in CAL, press the "ENT" key. The following prompt will be displayed.

Sample & Hold in CAL

Sample & Hold = 0

To edit the Sample & Hold in CAL, press the numeric keys that correspond to the desired percent. The Sample & Hold can be programmed to be either enabled or disabled. Press "0" to disable this function, or press "1" to enable this function. Press the "ENT" key to accept the value chosen.

Advance to the next parameter by pressing the "↓" key.

The display scrolls up with the bottom line reading Auto Calibration.

O2 High Set point
Cal Purge Time
Sample & Hold in CAL
Auto Calibration

Auto calibration, when enabled, permits the analyzer to automatically perform O2/CO Zero calibration and O2/CO Span calibration at programmable time intervals. A start time (Auto CAL. Hour), and a repetition period (Auto CAL> Period) for this auto calibration are field programmable.

To edit Auto Calibration press the "ENT" key. The following prompt will be displayed.

Auto CAL. Period
Period = 24 hours

The auto cal period is the time period (in hours) between auto calibrations. The reference start time for the first calibration is set below in the Auto CAL. Hour.

To edit the Auto CAL. Period press the numeric keys that correspond to the desired hours. The programmable range is from 1 hour to 24 hours.

Press the “ENT” key to accept this value and move to the Auto CAL. Hour setup screen shown below.

Auto CAL. Hour **Hour = 0**

The Auto CAL. Hour is the hour of the day (in military time) that the Auto CAL> Period is referenced from. As an example, if the Auto CAL. Hour is programmed to 12, and the Auto CAL. Period is programmed to 8, the auto calibrate routine will start at 12:00 Noon, and repeat at 8:00 pm, 4:00 am, and 12:00 Noon again. This cycle will repeat as long as the times are not changed and the analyzer is not turned off. If the analyzer is turned off, the auto calibrate routine will begin again when the analyzer is turned on and repeat at the Auto CAL. Period time interval. When the Auto CAL. Hour is reached the system will synchronize to this time and the original cycle will again become active.

To edit the Auto CAL. Hour press the numeric keys that correspond to the desired hour. The programmable range is from 1 hour to 23 hours. Press the “ENT” key to accept this value and move to the Auto CAL. Enable setup screen shown below.

Auto CAL. Enable **Enable = 0**

To edit the Auto CAL. Enable either press the “1” numeric key to enable the auto calibrate routine, or the “0” numeric key to disable the auto calibrate routine. Press the “ENT” key to accept this value and return to the parameter screen.

Advance to the next parameter by pressing the “↓” key.

The display scrolls up with the bottom line reading Set Time HH:MM:

Cal Purge Time **Sample & Hold in CAL** **Auto Calibration** **Set Time HH:MM**

To program the Set Time press the “ENT” key. The following prompt will be displayed:

ENT to change **CLR to Return** **Time = 09:34**

Pressing the “ENT” key will bring up the display below. Pressing the “CLR” key will return you to the Parameter screen.

Set Time HH:MM **Time =**

To edit the Set Time, press the numeric keys that correspond to the desired hours and minutes. The time must be entered in military time. Press the “ENT” key to accept this value. **DO NOT PUSH THE ENTER KEY IF THERE IS NO TIME ENTERED.**

Advance to the next parameter by pressing the “↓” key.

The display scrolls up with the bottom line reading Comms. Setup.

Sample & Hold in CAL **Auto Calibration** **Set Time HH:MM** **Comms. Setup**

To edit Comms. Setup, press the “ENT” key. The following prompt will be displayed.

MODBUS I.D. **I.D. = 0**

When communicating with a remote device (DCS, PC, PLC, etc.), each O_2 analyzer must have a unique ID number between 0 and 255.

To edit the Modbus ID, press the numeric keys that correspond to the desired number and press the “ENT” key to accept this value.

The following screen will now be displayed:

MODBUS Port Parity
0=Even, 1=Odd
Parity = 0

If the system is communication with a remote device, the remote device and the analyzer must both be communicating with the same parity. Press either the “0” or “1” key depending on the parity desired, and then the “ENT” key.

The following screen will be displayed.

MODBUS Baud Rate
4800, 9600, 19200
Baud = 09600

If the system is communication with a remote device, the remote device and the analyzer must both be communicating with the Baud Rate. Press the numeric keys that correspond to the desired baud rate, and then the “ENT” key.

Pressing the clear “CLR” key from any screen (some screens require the “CLR” key to be pressed more than once) will bring up the Main Menu screen.   The Main Menu will now be displayed on the screen.

MAIN MENU
1 - RUN   4 - UTILITIES
2 - CALIBRATION
3 - SET PARAMETERS

The selection of ‘1’ from the Main Menu places the Model DT3000 in automatic run mode. The Model DT3000 will begin its normal operation of measuring O_2 levels in air samples following the guidelines established in the parameter routine.

SECTION 7

CALIBRATION

7.1 INTRODUCTION

A Zirconia sensor based oxygen analyzer needs initial and periodic calibration, using known test gases, for several reasons.

> Initial calibration is required to set the linearization curve for the installed conditions.
>
> Periodic calibration to reset linearization due to electronic component aging, sensor aging, and changes in the flue gas conditions.

For EPA reporting a calibration check is required once every 24 hours.

For trim control a calibration is typically required once every three months, or whenever a new sensor is installed.

7.2 CALIBRATION

For calibration, connect the Cal gases as described earlier in this manual.

The Zero or Span calibration gases are to be introduced to the calibration port of the Model DT3000 insitu probe at positive pressure. Calibration gas flow rates should be adjusted to around 5 SCFH.

To begin a Calibration cycle, start at the Main Menu.

```
MAIN MENU
1 - RUN      4 - UTILITIES
2 - CALIBRATION
3 - SET PARAMETERS
```

Press the “2” key to enter the Calibration screen.

1-Cal Zero Adjust
2-Cal Span Adjust
3-Zero Check
4-Span Check

From here press the “1” key for Cal Zero Adjust and the “2” key for Span Cal Adjust.

To call for a Zero calibration, select 1 on the Calibration Menu. The display will then appear as follows:

**** Calibrate ****
Manual Zero
Purge Delay = 120
O2 = 2.2 [2.0]

The second line states that the calibration is a Zero Cal. The third line shows that the purge time has 120 seconds left. This time starts counting down, in seconds, from the Cal Purge Time that was set in the Parameters.

The final line is the O_2 level, in percent, based on the previous calibration. The number in brackets is the value of the O_2 in the Zero calibration gas that is entered in the Calibration Screen under Zero Check. After the Cal Purge Time has elapsed, the Model DT3000 will wait an additional 5 seconds to allow sampling of the calibration gas. At the finish of the Cal Purge Time the display reverts back to the Calibration Menu.

To complete the calibration procedure, the Span Adjust must be accessed through the Calibration Menu by selecting 2. At this point the Span solenoid opens admitting the Span gas to the Model DT3000. The span flow should be adjusted as the zero flow was previously. The display will change to:

**** Calibrate ****
Manual Span
Purge Delay = 120
O2 = 12.05 [15.00]

The second line states that the span calibration was called for. The third line shows that the purge time has 120 seconds left. This time starts counting down, in seconds, from the Cal Purge Time that was set in the Parameters (See Section 6.4).

The final line is the O_2 level, in percent, based on the previous calibration. The number in brackets is the value of the O_2 in the Span calibration gas that is entered in the Calibration Screen under Span Check. After the Cal Purge

Time has elapsed, the Model DT3000 will wait an additional 5 seconds to allow sampling of the calibration gas. At the finish of the Cal Purge Time the display reverts back to the Calibration Menu

If the analyzer fails calibration for any reason it reverts back to the pre-calibrate conditions.

7.5 ZERO AND SPAN CHECK

Two other features available from the Calibration Menu are the Zero and Span Check. Pressing 3 from the Calibration Menu brings up the Zero Cal Gas Set screen.

Set O2 Zero CAL Gas
ZERO = 2.00 pct

Press the numeric keys that correspond to the oxygen concentration found on the Zero calibration gas bottle/tank. This number represents the analyzer's Zero value calibration.

Pressing 4 from the Calibration Menu brings up the Span Cal Gas Set screen.

Set O2 Span CAL Gas
SPAN = 15.00 pct

Press the numeric keys that correspond to the oxygen concentration found on the Span calibration gas bottle/tank. This number represents the analyzer's Span value calibration.

7.7 ABORT TECHNIQUES FROM CALIBRATION

In calibration there is a purge delay time before the calibration commences. Pressing the clear key within this delay time will abort the calibration.

SECTION 8

DIAGNOSTIC DISCUSSION

8.1 INTRODUCTION

During operation up of the Model DT3000 various diagnostic messages may appear in the display. Each of these messages is discussed below:

8.2 CALIBRATION FAULT

If during the calibration period the analyzer detects an O_2 value less than 6 points below the calibration gas value, or 6 points above the calibration gas value. A “Calibration Fault” alarm message will appear on the bottom line of the Run screen to indicate the analyzer is out of calibration.

The on board alarm contact will close during this alarm condition providing a means for remote alarm indication.

8.3 HIGH SENSOR TEMP

If the temperature of the Zirconia sensor exceeds the analyzer’s preset upper limit a “High Sensor Temp” alarm message will appear on the bottom line of the Run screen to indicate the analyzer is out of calibration.

The on board alarm contact will close during this alarm condition providing a means for remote alarm indication.

In addition to the above the analyzer will attempt to reduce the temperature of the Zirconia cell. If the temperature returns to normal the alarm will clear.

8.4 LOW SENSOR TEMP

If the temperature of the Zirconia sensor falls below the analyzer’s preset lower limit a “Low Sensor Temp” alarm message will appear on the bottom line of the Run screen to indicate the analyzer is out of calibration.

The on board alarm contact will close during this alarm condition providing a means for remote alarm indication.

In addition to the above the analyzer will attempt to increase the temperature of the Zirconia cell. If the temperature returns to normal the alarm will clear.

SECTION 9

INSTRUMENT DESCRIPTION

9.1 INTRODUCTION

The Model DT3000 microprocessor controller contains features necessary to maintain the oxygen sensor at its operating temperature, and to display values corresponding to percentage of oxygen in the flue gas.

The Model DT3000 comes with a 4-line, 80-character LCD display and a 16-key membrane keypad. User interface is through the keypad and LCD display, which displays measurements, system status messages, and alarms. Sensor calibration is also initiated through the keypad.

9.2 O_2 CELL ANALOG CIRCUIT

The Zirconia cell provides a current output that is conditioned and amplified to provide a voltage output to a microprocessor.

The signal from the Zirconia cell is in the form of a very low ion current.

9.3 O_2 CELL THERMOCOUPLE CIRCUIT

A type K thermocouple is inserted into the center of the Zirconia cell for monitoring cell temperature. This thermocouple provides a voltage that is proportional to the temperature of the Zirconia cell. A typical cell temperature is 1000°F to provide a thermocouple output of 22.250 mV. The resistance of the thermocouple is approximately 2 ohms at 70°F when disconnected.

The O_2 cell thermocouple voltage signal is conditioned and amplified to provide a voltage output to a microprocessor

9.4 RELAY OUTPUTS

The Model DT3000 provides relay outputs (SPST) for low and high set point alarms, system fault and back purge. These relay outputs are provided on

TB1 located on the back panel of the enclosure. All relay contacts are Normally Open (N.O.) and will provide a contact closure when energized.

9.5 INPUTS

The Model DT3000 has digital inputs for initiating a remote zero and span procedure. 120VAC applied to the appropriate input will induce the appropriate procedure.

SECTION 10

OXYGEN SENSOR

10.1 OXYGEN SENSOR - GENERAL

The oxygen sensor consists of a Zirconia oxide sensor, which is threaded into the sample cell. The sensor consists of two component groups, sensor exterior (air reference) and inner sensor (sample). It creates an electrical signal when oxygen level on the sample side of the cell is not equal to oxygen levels on the reference airside. This signal is proportional to the difference in oxygen levels.

10.2 ZIRCONIA SENSOR ASSEMBLY

The O_2 cell comprises of a Zirconia oxide sensor and a type-K thermocouple inserted into the center of the Zirconia sensor. A heater element surrounds the Zirconia sensor and maintains the Zirconia cell at about 1000°F. Air reference holes are provided at the top of the Zirconia sensor.

The complete Zirconia cell with thermocouple, threads into the sample cell for direct measurement of flue gas (insitu-wet), or conditioned sample gas (extractive-dry).

SECTION 11

TROUBLE SHOOTING

11.1 OVERVIEW

The system troubleshooting section is divided into two parts that describe how to identify and isolate oxygen analyzer faults. The first part describes sensor faults and the second describes electronic faults. The alarms and messages caused by either may overlap.

11.2 SPECIAL TROUBLESHOOTING NOTES

a. Grounding: It is essential that adequate grounding precautions are taken when system is being installed. Thoroughly check all grounding connections before and after faultfinding.

b. Loose Integrated Circuits: The electronics uses a microprocessor and supporting integrated circuits. Should the electronics receive rough handling during installation, or is installed in a location that is subject to severe vibration, an integrated circuit (IC) could work loose. Make sure all IC's are fully seated before system troubleshooting begins.

11.3 SENSOR TROUBLESHOOTING

a. Sensor Faults: Listed below are three symptoms of sensor failure.

1. The system does not respond to changes in oxygen concentration.

2. The system responds to changes in oxygen concentration, but does not give correct indication.

3. The system does not give an acceptable indication of the value of the test gas being applied during calibration.

b. Fault Finding: The following Table is a guide for finding faults of the above symptoms.

MALFUNCTION	POSSIBLE FAILURE	CHECK	REMEDY
Heater is cold and T/C mV output is less than set point.	Thermocouple	Thermocouple continuity Check electrical connections / Thermocouple polarity	Replace T/C or replace Zirconia sensor. Correct wiring
	Fuse Blown	Check Fuse	Replace fuse.
	Solid state relay to heater	Failure of electronics or S.S Relay	Replace mother board or solid state relay
Heater is hot and T/C mV output is at set point.	No cell mV at sensor.	Cell mV input to electronics and mV at sensor head.	Replace Zirconia sensor.
	Sensor mV normal but no input to electronics.	Cable connection.	Check cable connection.
	Cell mV normal at sensor head and input to electronics	Failure of electronics	Replace oxygen PCB and return faulty board to Datatest.

MALFUNCTION	POSSIBLE FAILURE	CHECK	REMEDY
System responds to oxygen concentration changes but does not give correct reading.	Calibration error.	System calibration.	Recalibrate system.
	Vacuum leak. Air getting in sample line .	Extractive system. Check sample line and fittings.	Stop air leak.
	Leaky zero, span or back purge solenoid	Check back purge and cal solenoids.	Stop solenoid leak.
	Failure of electronics.	Cell mV input to electronics.	Replace oxygen PCB and return faulty board to Datatest.
System does not give accurate indication of applied test gas.	Blocked sample line.	Test sample inlet port. Verify calibration gas concentrations.	Clean port. Replace calibration gas container.

11.4 ELECTRONICS TROUBLESHOOTING

The Model DT3000 has on-board diagnostic features, which aid faultfinding. Normally the user will not need to use electronic testing equipment in fault diagnostic. Almost all reasons for system malfunction are displayed by either an alarm or a fault message on the liquid crystal display.

11.5 ALARM MESSAGES

The Model DT3000 has various diagnostic alarm features, which may appear in the display.

Low Sensor Temp
High Sensor Temp
Backpurge
Thermocouple Fault
Calibration Fault
Remote Calibration

Each of these alarm messages is discussed in this manual.

SECTION 12

SERVICE AND NORMAL MAINTENANCE

12.1 OVERVIEW

This section describes routine maintenance of the Model DT3000 Oxygen Analyzer. Spare parts referred to are available from Datatest. Observe warning and caution labels.

12.2 PRELIMINARY CHECKS

The following preliminary checks will help isolate problems in the analyzer. Run these checks before beginning any repair work. Check parameter and displays according to instructions in Section 4, System Startup.

WARNING: Wear heat resistance gloves when handling hot sensor and analyzer parts. The parts may be hot enough to cause severe burns.

a. Check Display for Alarms: Go through normal power up procedure. Allow enough time for sensor to reach proper temperature. Check display for alarms. If there are alarms, troubleshoot.

b. Run Calibration Check: Run calibration check procedure according to section 7. If calibration is successful, no problem exists. If calibration fails, shut off power and make sure that all wires and gas lines are properly connected to analyzer. If everything checks out properly, proceed to step c.

c. Check Thermocouple Output: Turn power on. Check thermocouple mV output. It should be at the mV set point (22.25 mV +/- 0.2 mV). If output is incorrect, check heater fuse. If fuse is good, check heater and thermocouple resistance as follows.

1. Measure heater resistance. Measure resistance of heater element at heater terminal on O_2 Sensor Assembly. The resistance should be less than 2 ohms. If heater element is open circuit, replace sensor heater element in sample cell.

2. Measure thermocouple resistance. Measure the thermocouple resistance on top of the Zirconia sensor located on the sample cell or O_2 insitu head. The resistance of the thermocouple should be approximately 2 ohms at 70°F.

12.3 SENSOR CALIBRATION:

The Datatest Model DT3000 Oxygen Analyzer should be calibrated when installed. Under normal operation, sensor will not require frequent calibration. When calibration is required, follow the procedures in section 7.

12.4 SENSOR REMOVAL AND INSTALLATION:

SENSOR REMOVAL: This paragraph covers the oxygen sensor removal from the sample cell or insitu head. Use the following procedure to remove sensor from the Model DT3000 for repair or replacement.

1. Disconnect and turn off AC power to the O_2 control unit. Shut off all calibration gases. Do not attempt to work on sensor assembly until it as cooled to a comfortable working temperature.

2. Disconnect sample gas tubing, reference gas tubing, back purge and exhaust tubing to casting of O_2 sensor assembly.

3. For rack mount units, remove screws from front panel securing sensor assembly to panel. Remove sensor assembly. For Insitu units, remove O_2 probe assembly cover plate from air reference cell to expose Zirconia sensor.

4. Disconnect thermocouple wire extension, cell wires and heater wires from sensor ceramic connectors.

5. Using a 7/8" wrench, remove Zirconia sensor from its threaded port.

SENSOR INSTALLATION: Use the following procedure to install Zirconia sensor into the Model DT3000.

1. Using a 7/8" wrench, thread Zirconia sensor into casting of O_2 cell.

2. Connect type K thermocouple extension wires, cell wires and heater wires to ceramic connectors as follows:

TB1/6 THERMOCOUPLE (+) YEL
TB1/7 THERMOCOUPLE (-) RED

TB1/4 CELL SIGNAL (+)
TB1/5 CELL SIGNAL (-)

TB1/25 Heater – pulsed 10 VAC
TB1/26 Heater – pulsed 10 VAC

3. For extractive units, secure sensor assembly to front panel of control unit, or remote location as applicable. For Insitu units, replace O_2 probe assembly cover plate over the casting on the Insitu probe.

4. Connect sample gas tubing, reference gas tubing, back purge, and exhaust tubing to casting of O_2 sensor assembly.

5. Connect sensor thermocouple extension wire, cell signal wires, and heater wires to control unit as specified in 2 above.

12.5 HEATER ELEMENT REPLACEMENT

The heater element surrounds the threaded tip of the Zirconia sensor. Should this element fail for any reason, the Sensor housing assembly should be sent to Datatest for repair.

12.7 SPARE PARTS

Spare Parts List

PART NUMBER	DESCRIPTION	QUANTITY
DK5020	Zirconia Sensor Unit Including thermocouple assembly	1
300-TRH	Heater Transformer 8-10	1
DK5029	Solid State Relay (SSR), 10 Amp	1
3AG	Fuse, 2 amp	1
BLF3	Fuse, 3 amp	
DT3000-PCB	Main Controller Card	1

13 WARRANTY

Datatest guarantees this system for a period of eighteen (18) months from date of installation to be free from defects in material and workmanship.

Our obligation under this guarantee is limited to repairing or replacing any instrument or part thereof which shall, within the above specified time, be returned to us with transportation charges prepaid, and prove after our examination to be thus defective. Should the product be found not to be defective a diagnostic and recalibration charge will apply.

The gas sensor element is excluded from this warranty.

In the event that the customer requires a Datatest field service technician or engineer on site, the customer will be billed for this service at our standard rate. This applies whether the equipment is in or out of warranty. This daily rate is based on the man-days spent 'on site', plus travel time. Expenses for travel and living are billed at cost.

Datatest personnel will not accept instruments returned under this warranty, to the Datatest plant, without prior authorization.

The user must prepay Freight for Returned Equipment. Datatest will assume the cost of shipping the unit back to the user by common carrier. If the user wishes it returned by other means, the user will be billed for the additional charges.

We reserve the right to discontinue instruments without notice, and to make modifications in design at any time without incurring any obligation to make such modifications to instruments previous sold.

13.1 RETURNING EQUIPMENT TO THE FACTORY

If factory repair of equipment is required, proceed as follows.

a. Secure a return authorization number from a Datatest Sales Office before returning the equipment. Equipment must be returned with complete identification in accordance with Datatest instructions or it will not be accepted.

In no event will Datatest be responsible for equipment without proper authorization and identification.

b. Carefully pack the equipment in a sturdy box with sufficient shock absorbing material to insure that no additional damage will occur during shipping.

c. In a cover letter, describe completely:

1. The symptoms that made you think the equipment is faulty.
2. The environment in which the equipment has been operating (i.e. temp, corrosive gasses, moisture, etc.).
3. Name of your company and plant name where equipment was removed.
4. Plant contact and phone number.
5. Whether warranty service or non-warranty service is expected.
6. Complete shipping instructions for return of equipment.

d. Enclose the cover letter and purchase order and ship the equipment according to instructions provided in Datatest Return Authorization, prepaid to:

DATATEST Inc.
300 Valley Road
Hillsborough, NJ 08844
TEL: (908) 369-1590
FAX: (908) 369-1594

If warranty service is requested, the unit will be carefully inspected and tested at the factory. If failure was due to conditions listed in the standard Datatest warranty, the unit will be repaired or replaced at Datatest option, and an operating unit will be returned to the customer in accordance with shipping instructions furnished in the cover letter.

For equipment no longer under warranty, the equipment will be repaired at the factory and returned as directed by the purchase order and shipping instructions.

14 Modbus Registers

Operating information and status of the DT3000 can be sent to a remote computer/DCS/PLC via Modbus RTU protocol. The following are the register descriptions.

Diagnostic registers

40001	Message Counter. This register increments for every valid received message.
40002	Read register (03) message counter. This register is incremented for every received message that is a read holding register command.
40003	Invalid CRC message counter. This register is incremented for messages that have been received with a bad CRC.
40004	Exception response message counter. This register is incremented when the instrument transmits a MODBUS exception response.
40005	Reserved
40006	Last exception code. This register holds the last exception code that was transmitted.
40007-9	Reserved
40010-17	Last exception response message. Eight registers holding the character data of the last exception response that was transmitted.

System Registers

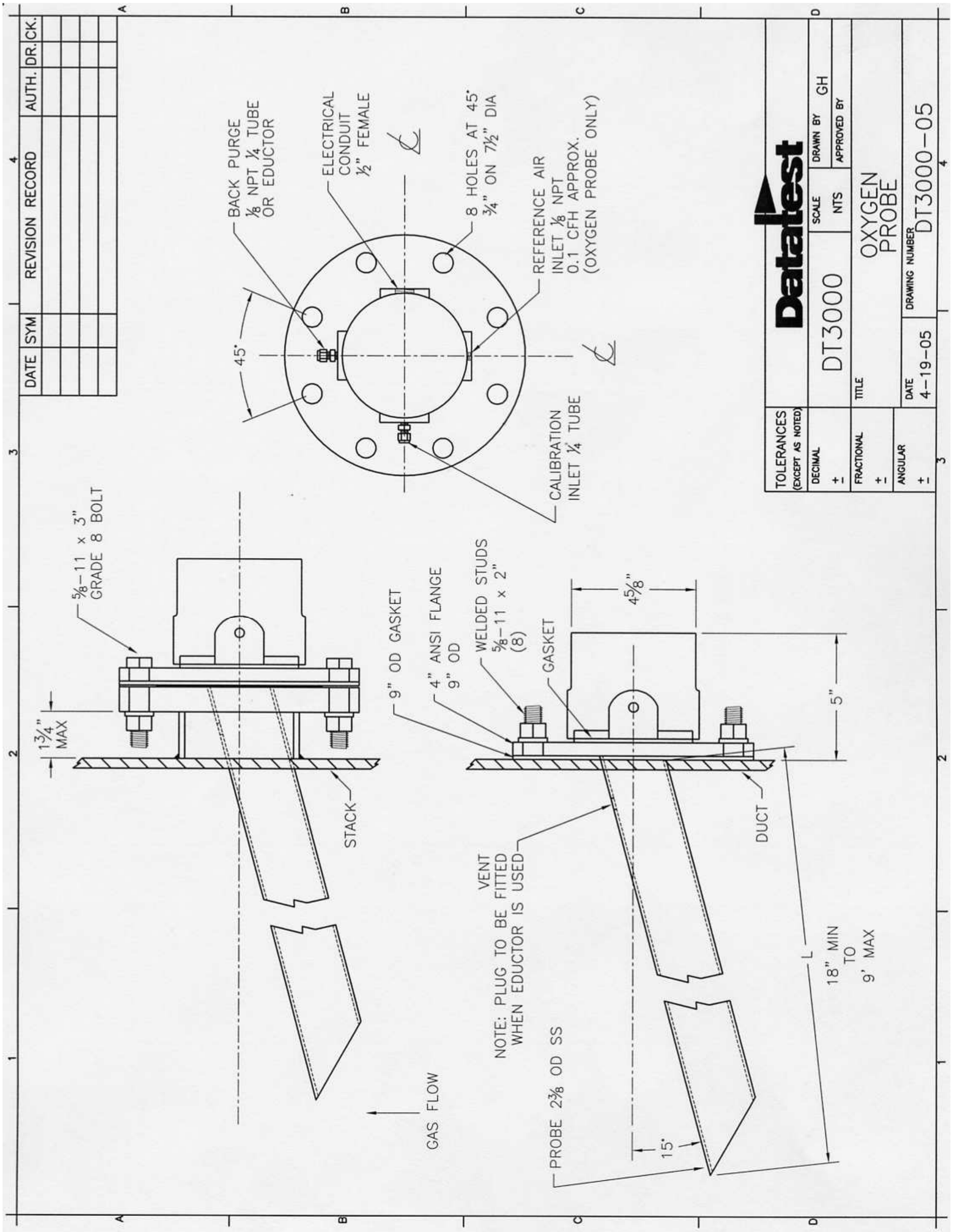
40021	Back purge timer. The incrementing back purge timer value in minutes.
40022	Back purge flag. Value equals 1 when the instrument is performing a back purge otherwise it is zero.
40023	System Status.

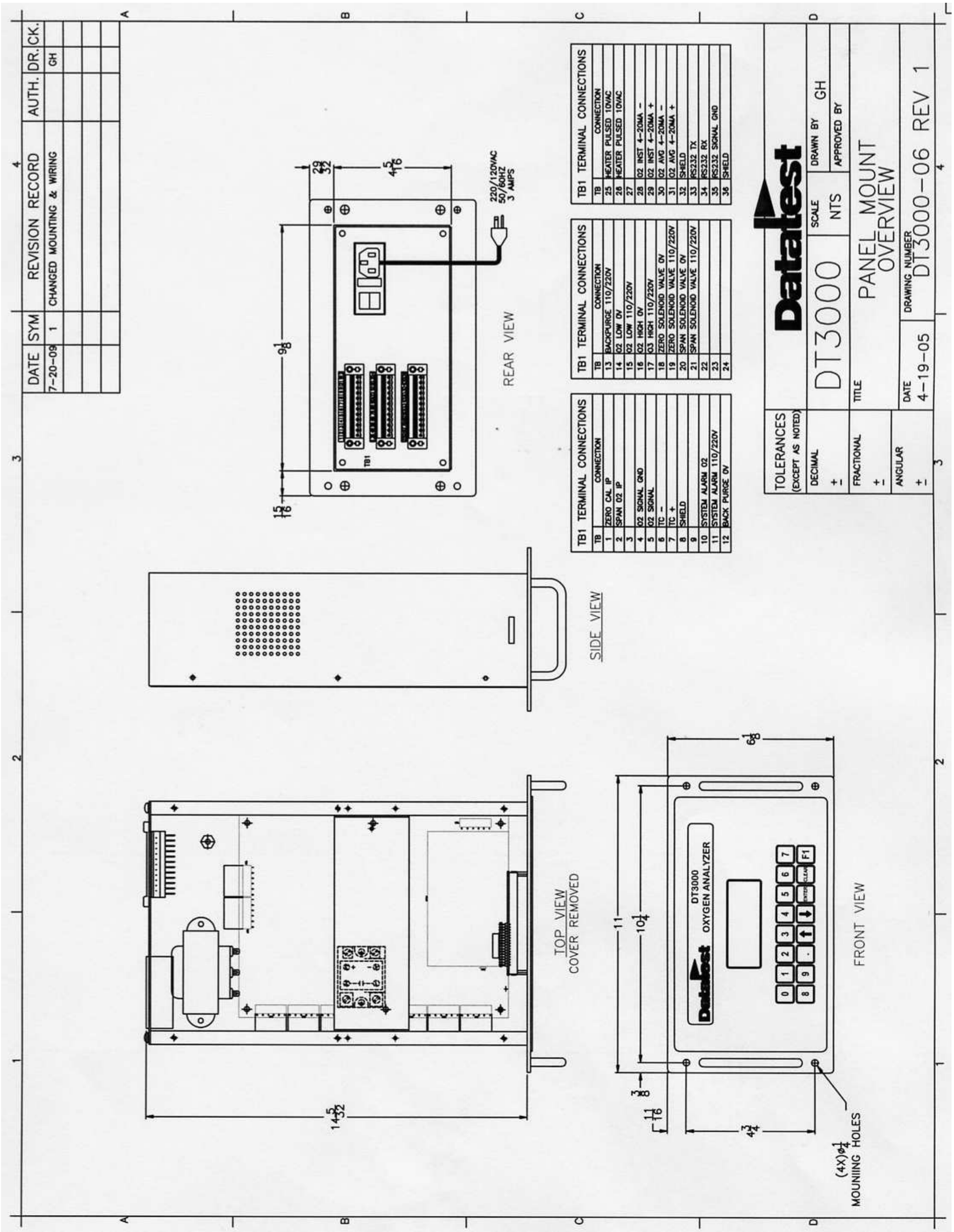
40031	O2 instantaneous reading. The register is an integer value. The oxygen reading is multiplied by 100 to give an integer value in increments of hundredths. This is the fastest changing O2 value. The value is in the range of 0 to 2500.
40032	O2 instantaneous average reading. The register is an integer value of the "instantaneous" rolling seconds average. The O2 reading is multiplied by 100 to give an integer value in increments of hundredths. The value is in the range of 0 to 2500.
40033	O2 average reading. The register is an integer value of the minute rolling average. This O2 reading is multiplied by 100 to give an integer value in increments of hundredths. This is the slowest changing O2 value. The value is in the range of 0 to 2500.
40034-35	O2 instantaneous reading. These registers hold a floating-point value. This is the fastest changing O2 value.
40036-37	O2 instantaneous average reading. These registers hold a floating-point value of the "instantaneous" rolling seconds average.
40038-39	O2 average reading. These registers hold a floating-point value of the "averaged" minute rolling average. This is the slowest changing O2 value

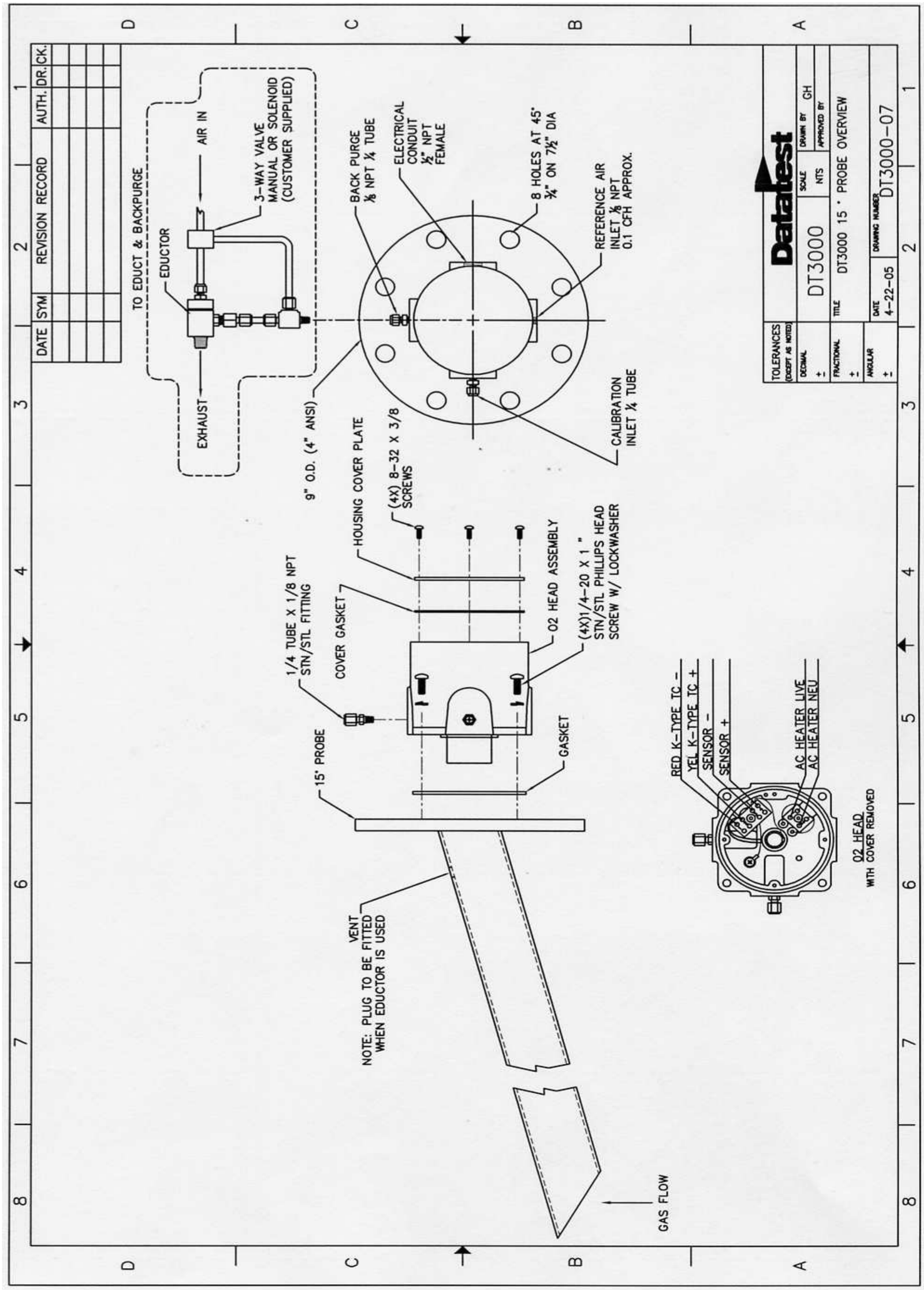
Appendix I – Drawings for Insitu Unit, Panel Mount Control Unit

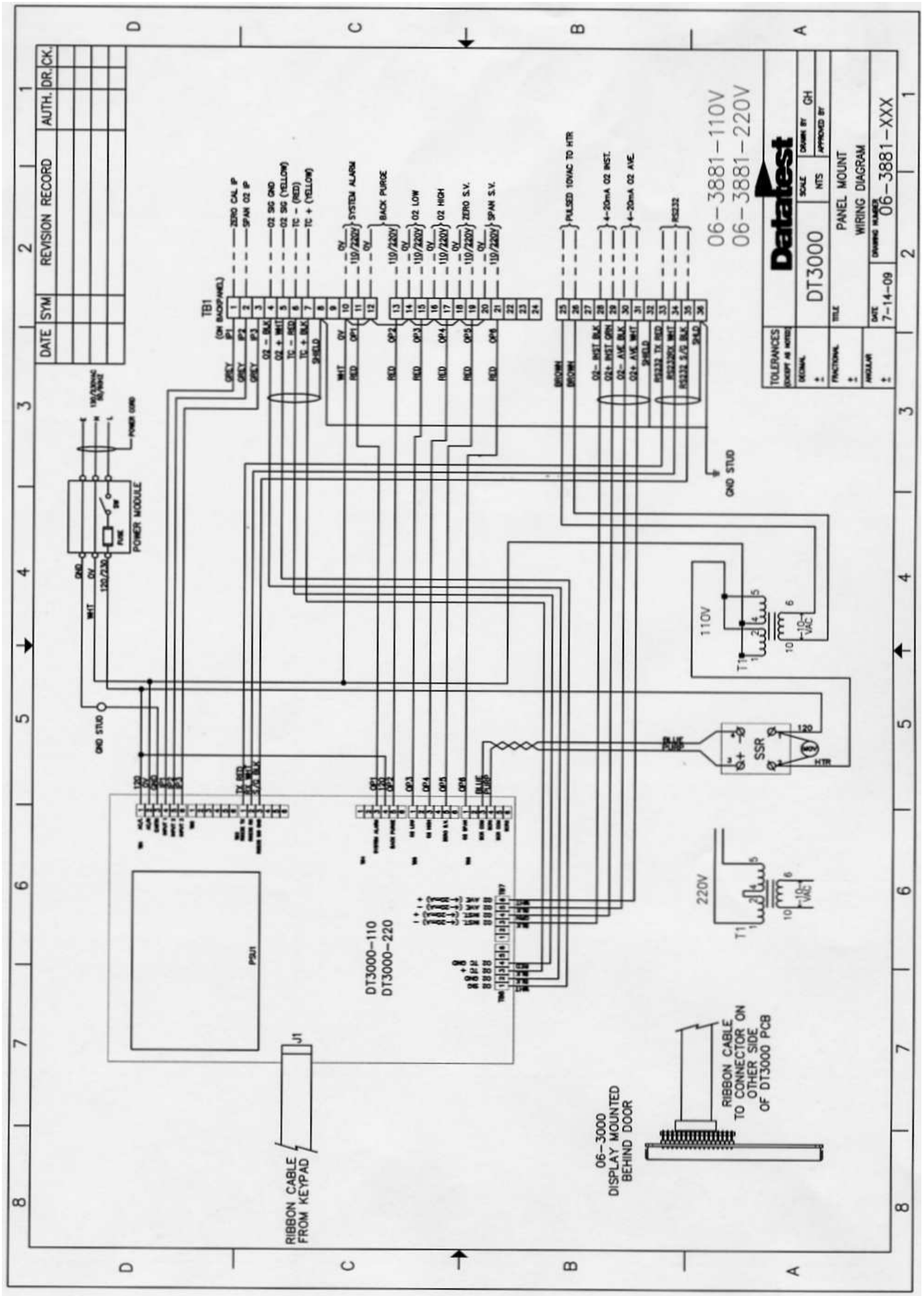
The reduced size drawings on the following pages are provided as typical for the specific design stated above. Larger drawings and/or electronic drawings are provided for the actual design purchased.

DT3000-05, Oxygen Probe
DT3000-06, Panel Mount Overview
DT3000-07, Oxygen Probe Overview
06-3881-XXXX, Panel Mount Wiring Diagram


REVISION RECORD
DATE
SYM
AUTH.
DR.
CK.
BACK PURGE
1/8 NPT 1/4 TUBE
OR EDUCTOR
ELECTRICAL
CONDUIT
1/2" FEMALE
8 HOLES AT 45°
3/4" ON 7½" DIA
REFERENCE AIR
INLET 1/8 NPT
0.1 CFH APPROX.
(OXYGEN PROBE ONLY)
45°
CALIBRATION
INLET 1/4 TUBE
5/8-11 x 3"
GRADE 8 BOLT
9" OD GASKET
4" ANSI FLANGE
9" OD
WELDED STUDS
5/8-11 x 2"
(8)
GASKET
4 5/8"
5"
1 3/4"
MAX
STACK
DUCT
VENT
NOTE: PLUG TO BE FITTED
WHEN EDUCTOR IS USED
L
18" MIN
TO
9' MAX
PROBE 2 3/8 OD SS
GAS FLOW
15°
TOLERANCES
(EXCEPT AS NOTED)
DECIMAL
±
FRACTIONAL
±
ANGULAR
±
Datatest
DT3000
SCALE
NTS
DRAWN BY
GH
APPROVED BY
TITLE
OXYGEN
PROBE
DATE
4-19-05
DRAWING NUMBER
DT3000-05


DATE
SYM
REVISION RECORD
AUTH.
DR.
CK.
7-20-09
1
CHANGED MOUNTING & WIRING
GH
TB1 TERMINAL CONNECTIONS
TB | CONNECTION
1 ZERO CAL IP
2 SPAN O2 IP
3
4 O2 SIGNAL GND
5 O2 SIGNAL
6 TC -
7 TC +
8 SHIELD
9
10 SYSTEM ALARM O2
11 SYSTEM ALARM 110/220V
12 BACK PURGE 0V
TB1 TERMINAL CONNECTIONS
TB | CONNECTION
13 BACKPURGE 110/220V
14 O2 LOW 0V
15 O2 LOW 110/220V
16 O2 HIGH 0V
17 O3 HIGH 110/220V
18 ZERO SOLENOID VALVE 0V
19 ZERO SOLENOID VALVE 110/220V
20 SPAN SOLENOID VALVE 0V
21 SPAN SOLENOID VALVE 110/220V
22
23
24
TB1 TERMINAL CONNECTIONS
TB | CONNECTION
25 HEATER PULSED 10VAC
26 HEATER PULSED 10VAC
27
28 O2 INST 4-20MA -
29 O2 INST 4-20MA +
30 O2 AVG 4-20MA -
31 O2 AVG 4-20MA +
32 SHIELD
33 RS232 TX
34 RS232 RX
35 RS232 SIGNAL GND
36 SHIELD
220/120VAC
50/60HZ
3 AMPS
REAR VIEW
TB1
SIDE VIEW
TOP VIEW
COVER REMOVED
FRONT VIEW
DT3000
OXYGEN ANALYZER
(4X)ϕ1/4
MOUNTING HOLES
9 3/8
5 4/16
14 5/32
6 1/8
11
10 1/4
4 3/4
TOLERANCES
(EXCEPT AS NOTED)
DECIMAL
FRACTIONAL
ANGULAR
DT3000
SCALE
NTS
DRAWN BY
GH
APPROVED BY
TITLE
PANEL MOUNT
OVERVIEW
DATE
4-19-05
DRAWING NUMBER
DT3000-06 REV 1

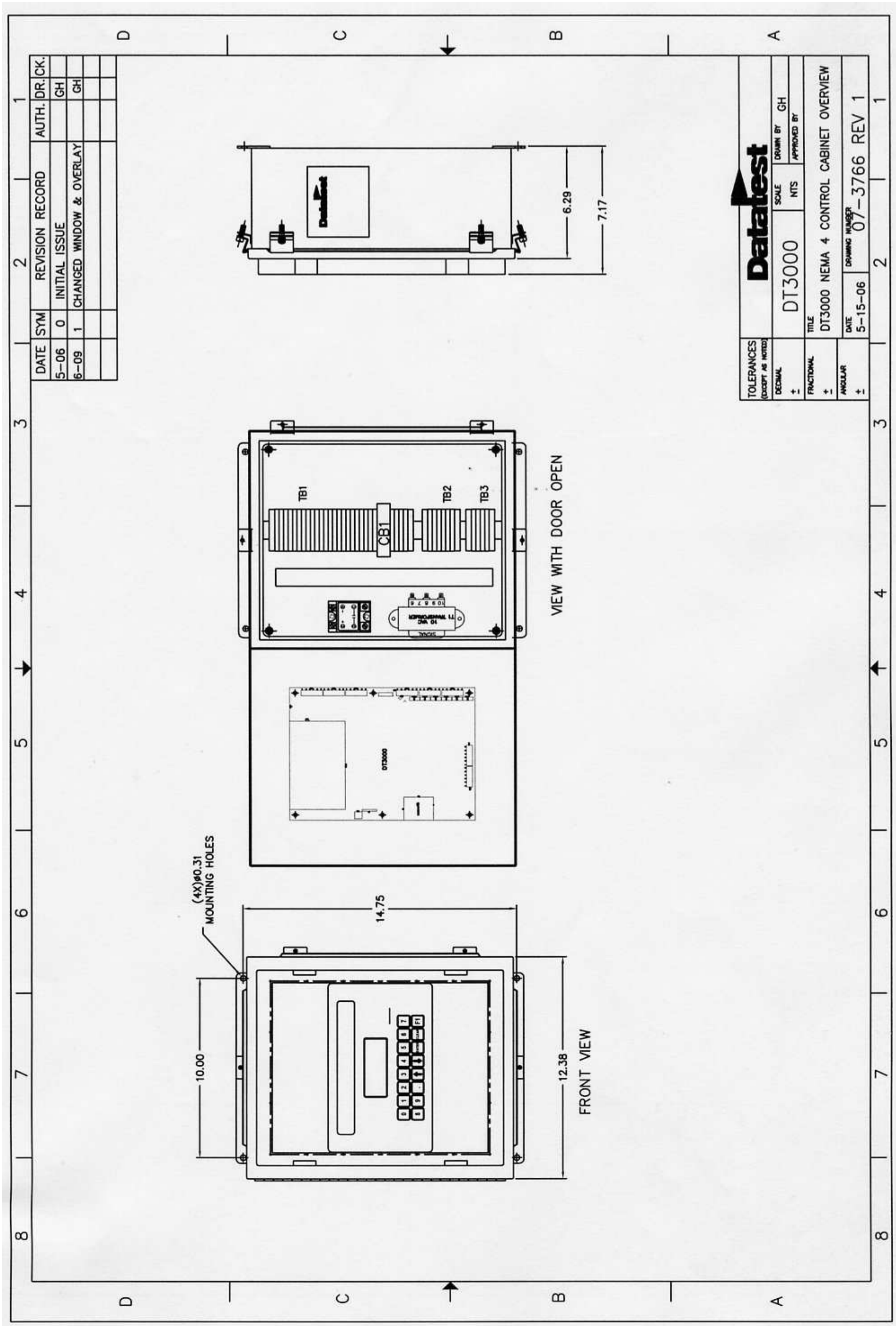

TO EDUCT & BACKPURGE
EDUCTOR
AIR IN
3-WAY VALVE MANUAL OR SOLENOID (CUSTOMER SUPPLIED)
EXHAUST
BACK PURGE ⅛ NPT ¼ TUBE
ELECTRICAL CONDUIT ½" NPT FEMALE
8 HOLES AT 45° ¾" ON 7½" DIA
REFERENCE AIR INLET ⅛ NPT 0.1 CFH APPROX.
CALIBRATION INLET ¼ TUBE
9" O.D. (4" ANSI)
HOUSING COVER PLATE
(4X) 8-32 X 3/8 SCREWS
1/4 TUBE X 1/8 NPT STN/STL FITTING
COVER GASKET
02 HEAD ASSEMBLY
(4X)1/4-20 X 1" STN/STL PHILLIPS HEAD SCREW W/ LOCKWASHER
GASKET
15' PROBE
VENT
NOTE: PLUG TO BE FITTED WHEN EDUCTOR IS USED
GAS FLOW
RED K-TYPE TC -
YEL K-TYPE TC +
SENSOR -
SENSOR +
AC HEATER LIVE
AC HEATER NEU
02 HEAD WITH COVER REMOVED
REVISION RECORD
DATE
SYM
AUTH.
DR.
CK.
TOLERANCES (EXCEPT AS NOTED)
DECIMAL
FRACTIONAL
ANGULAR
Datatest
DT3000
SCALE NTS
DRAWN BY GH
APPROVED BY
TITLE DT3000 15' PROBE OVERVIEW
DATE 4-22-05
DRAWING NUMBER DT3000-07

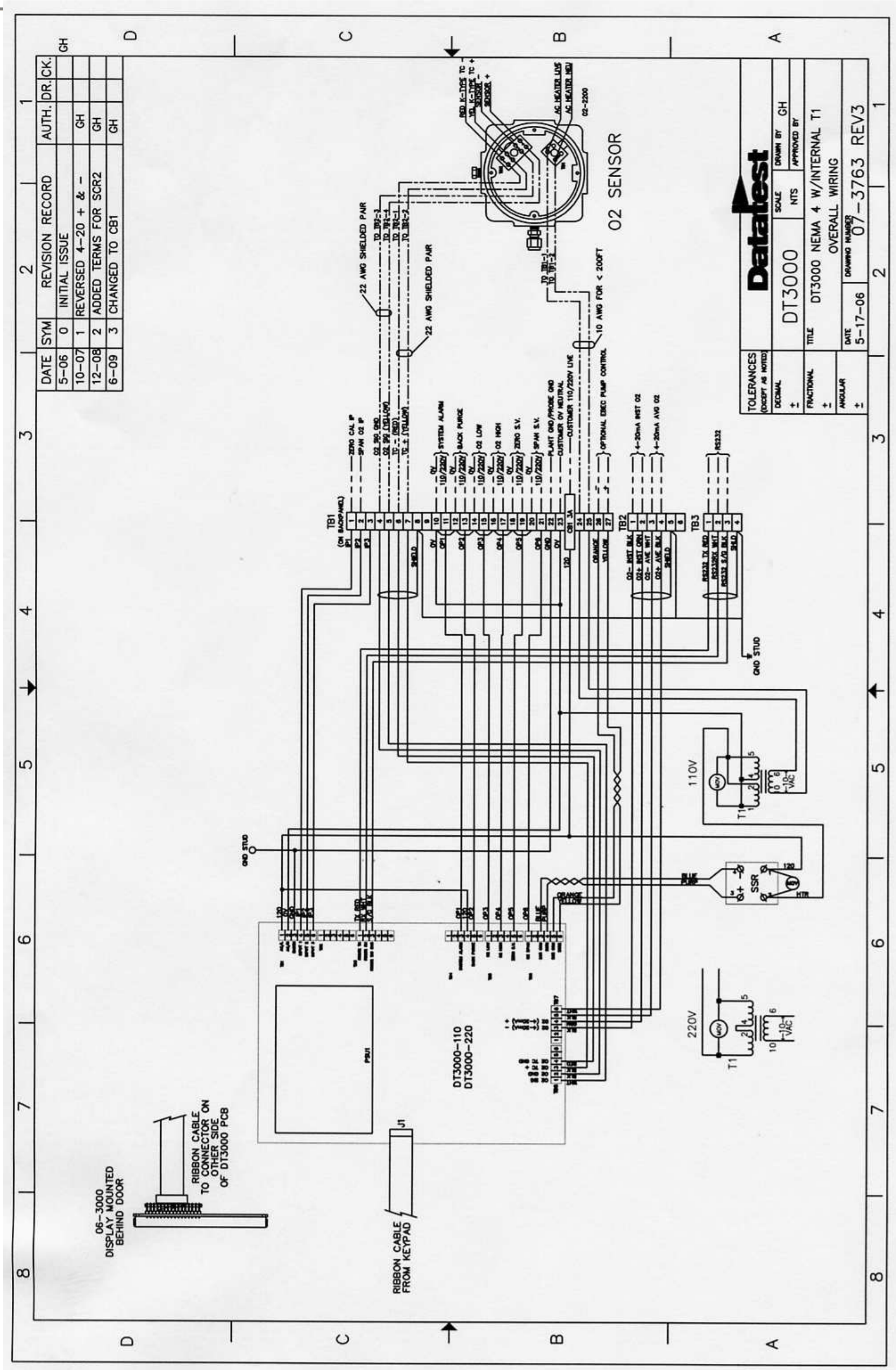

06-3881-110V
06-3881-220V
DT3000
PANEL MOUNT
WIRING DIAGRAM
06-3881-XXX
7-14-09
DT3000-110
DT3000-220
RIBBON CABLE
FROM KEYPAD
06-3000
DISPLAY MOUNTED
BEHIND DOOR
RIBBON CABLE
TO CONNECTOR ON
OTHER SIDE
OF DT3000 PCB
110V
220V
SSR

Appendix II – Drawings for Insitu Unit, NEMA 4 Control Unit

The reduced size drawings on the following pages are provided as typical for the specific design stated above. Larger drawings and/or electronic drawings are provided for the actual design purchased.

07-3766 Rev. 1 Control Cabinet Overview
07-3763 Rev. 3 Overall Wiring

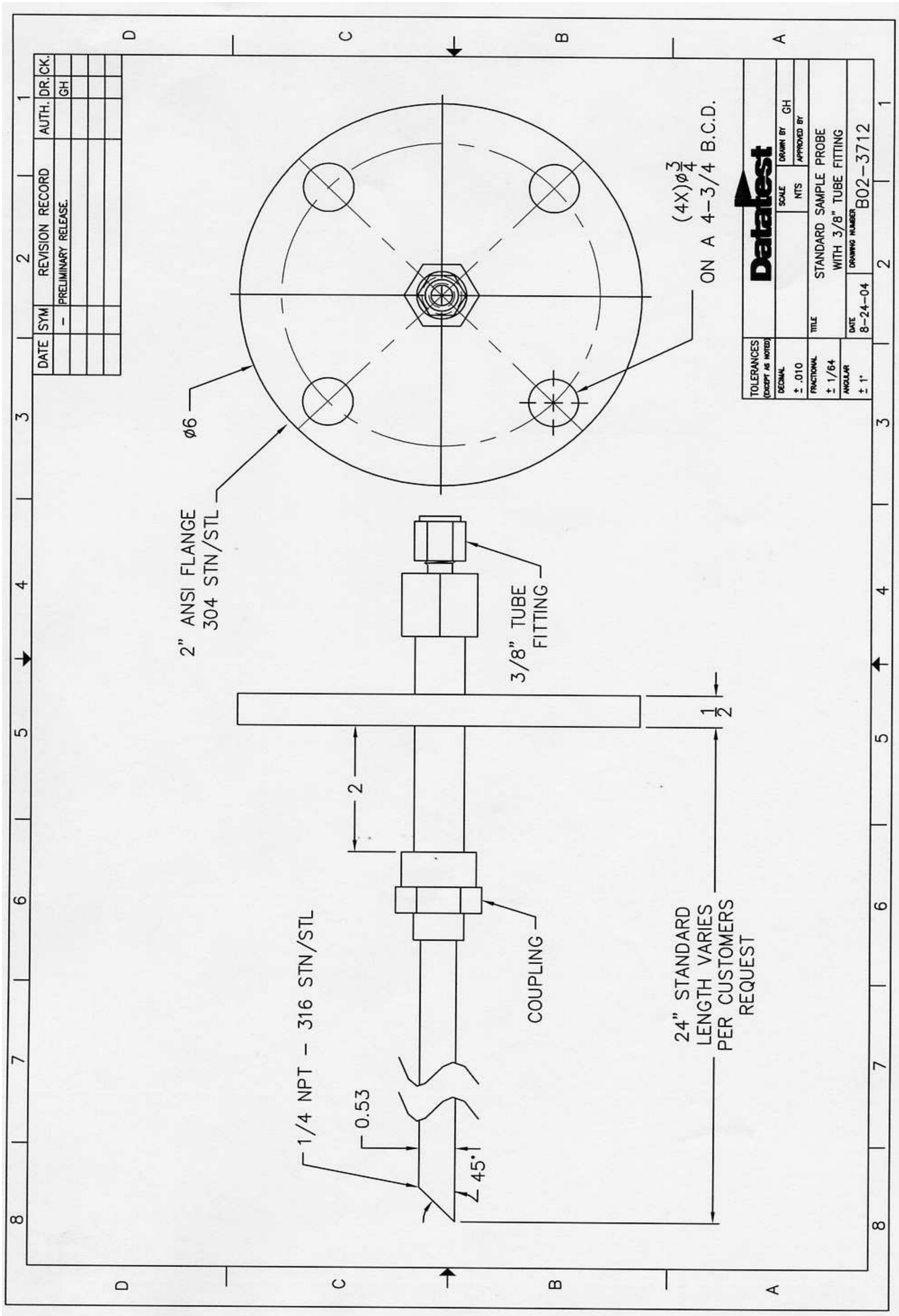

REVISION RECORD
DATE
SYM
AUTH.
DR.
CK.
5-06
0
INITIAL ISSUE
GH
6-09
1
CHANGED WINDOW & OVERLAY
GH
6.29
7.17
TB1
TB2
TB3
CB1
VIEW WITH DOOR OPEN
DT3000
(4X)⌀0.31
MOUNTING HOLES
14.75
10.00
12.38
FRONT VIEW
TOLERANCES
(EXCEPT AS NOTED)
DECIMAL
FRACTIONAL
ANGULAR
Datatest
DT3000
SCALE
NTS
DRAWN BY
GH
APPROVED BY
TITLE
DT3000 NEMA 4 CONTROL CABINET OVERVIEW
DATE
5-15-06
DRAWING NUMBER
07-3766 REV 1

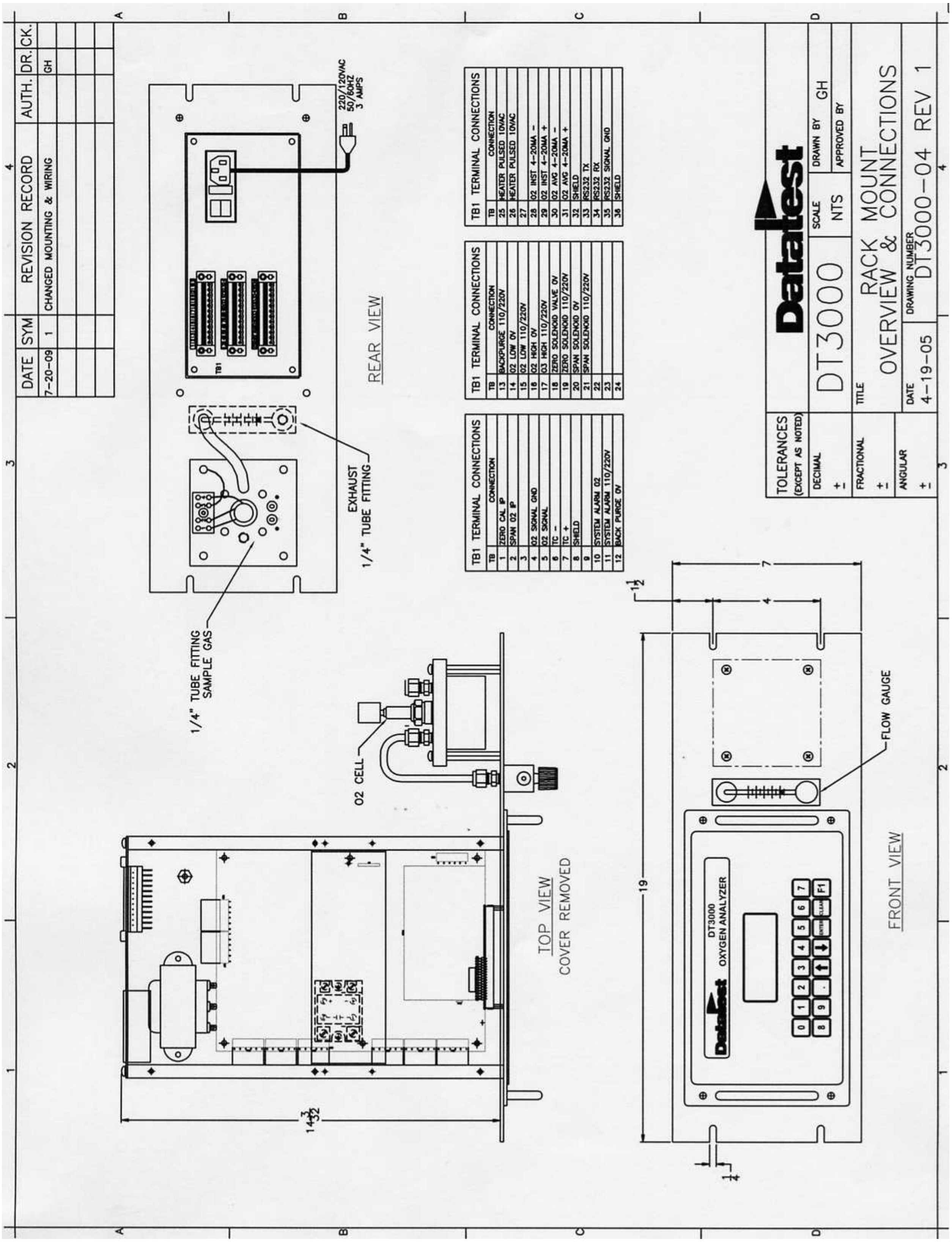

REVISION RECORD
DATE SYM REVISION RECORD AUTH. DR. CK.
5-06 0 INITIAL ISSUE GH
10-07 1 REVERSED 4-20 + & - GH
12-08 2 ADDED TERMS FOR SCR2 GH
6-09 3 CHANGED TO CB1 GH
O2 SENSOR
22 AWG SHIELDED PAIR
10 AWG FOR < 200FT
TB1
TB2
TB3
GND STUD
110V
220V
SSR
DT3000-110
DT3000-220
06-3000
DISPLAY MOUNTED
BEHIND DOOR
RIBBON CABLE
TO CONNECTOR ON
OTHER SIDE
OF DT3000 PCB
RIBBON CABLE
FROM KEYPAD
Datatest
DT3000
DT3000 NEMA 4 W/INTERNAL T1
OVERALL WIRING
5-17-06
07-3763 REV3

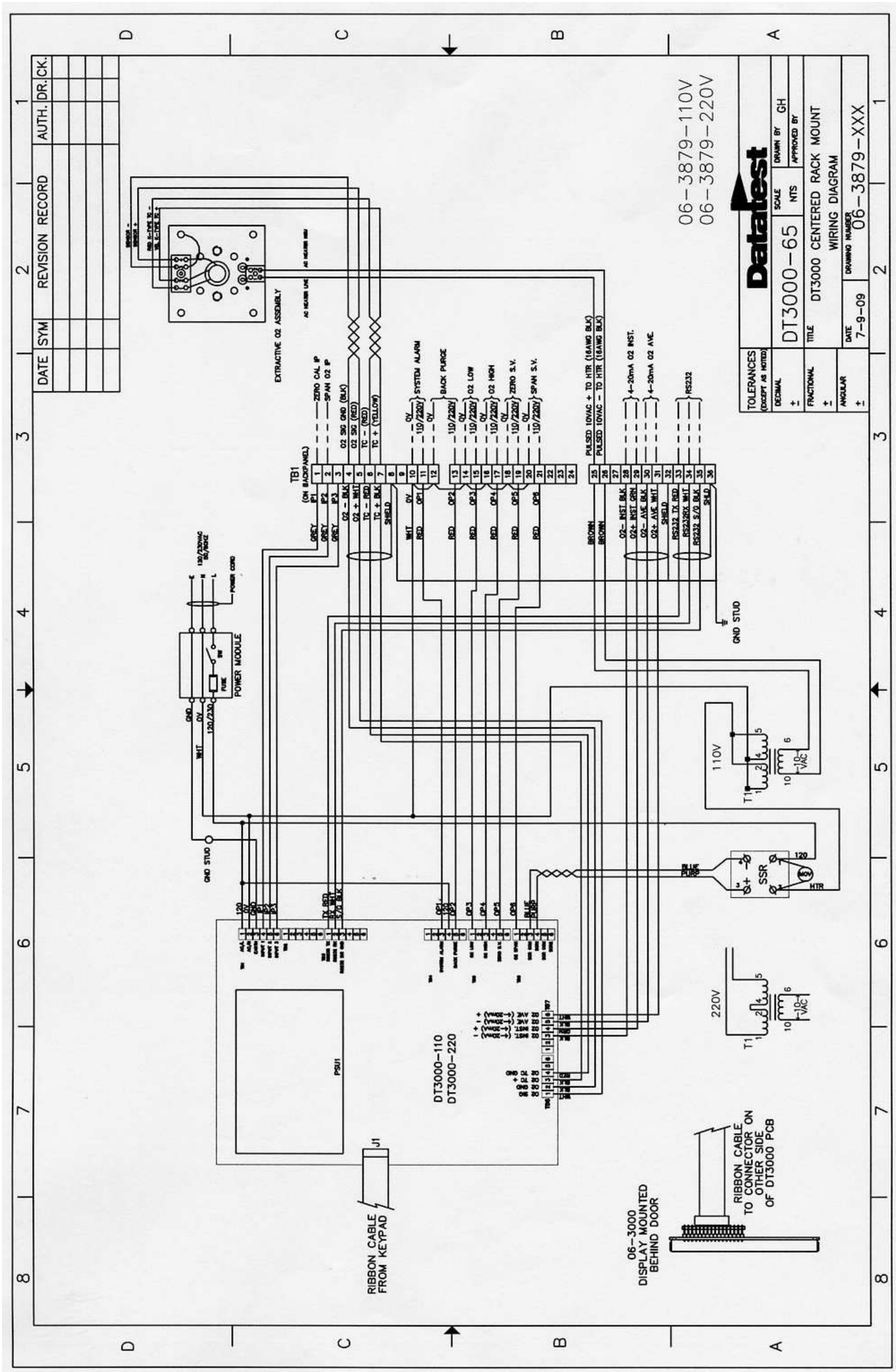
Appendix III – Drawings for Extractive Rack Mount Control Unit

The reduced size drawings on the following pages are provided as typical for the specific design stated above. Larger drawings and/or electronic drawings are provided for the actual design purchased.

B02-3712 Sample Probe
DT3000-04 Rev. 1 Rack Mount Overview & Connections
06-3879 Wiring Diagram


DATE
SYM
REVISION RECORD
AUTH.
DR.
CK.
-
PRELIMINARY RELEASE.
GH
2" ANSI FLANGE
304 STN/STL
ø6
(4X)ø3/4
ON A 4-3/4 B.C.D.
3/8" TUBE
FITTING
1/2
2
COUPLING
1/4 NPT - 316 STN/STL
0.53
45°
24" STANDARD
LENGTH VARIES
PER CUSTOMERS
REQUEST
TOLERANCES
(EXCEPT AS NOTED)
DECIMAL
± .010
FRACTIONAL
± 1/64
ANGULAR
± 1°
Datatest
SCALE
NTS
DRAWN BY
GH
APPROVED BY
TITLE
STANDARD SAMPLE PROBE
WITH 3/8" TUBE FITTING
DATE
8-24-04
DRAWING NUMBER
B02-3712

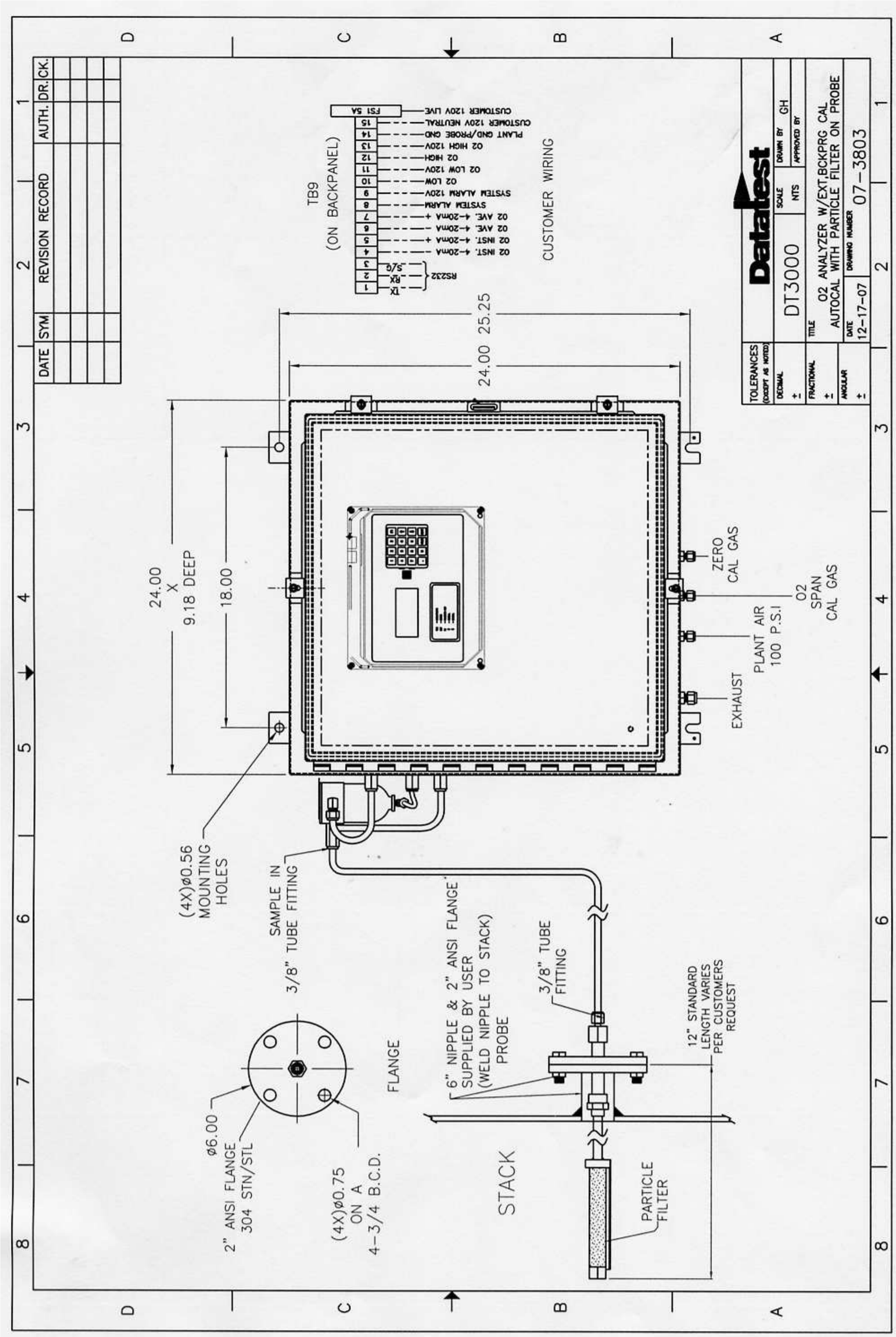

REVISION RECORD
DATE | SYM | REVISION RECORD | AUTH. | DR. | CK.
7-20-09 | 1 | CHANGED MOUNTING & WIRING | | GH |
220/120VAC 50/60HZ 3 AMPS
REAR VIEW
EXHAUST 1/4" TUBE FITTING
1/4" TUBE FITTING SAMPLE GAS
TB1 TERMINAL CONNECTIONS
TB | CONNECTION
1 ZERO CAL IP
2 SPAN O2 IP
3
4 O2 SIGNAL GND
5 O2 SIGNAL
6 TC -
7 TC +
8 SHIELD
9
10 SYSTEM ALARM O2
11 SYSTEM ALARM 110/220V
12 BACK PURGE 0V
TB1 TERMINAL CONNECTIONS
TB | CONNECTION
13 BACKPURGE 110/220V
14 O2 LOW 0V
15 O2 LOW 110/220V
16 O2 HIGH 0V
17 O3 HIGH 110/220V
18 ZERO SOLENOID VALVE 0V
19 ZERO SOLENOID 110/220V
20 SPAN SOLENOID 0V
21 SPAN SOLENOID 110/220V
22
23
24
TB1 TERMINAL CONNECTIONS
TB | CONNECTION
25 HEATER PULSED 10VAC
26 HEATER PULSED 10VAC
27
28 O2 INST 4-20MA -
29 O2 INST 4-20MA +
30 O2 AVG 4-20MA -
31 O2 AVG 4-20MA +
32 SHIELD
33 RS232 TX
34 RS232 RX
35 RS232 SIGNAL GND
36 SHIELD
TOLERANCES (EXCEPT AS NOTED)
DECIMAL ±
FRACTIONAL ±
ANGULAR ±
Datatest
DT3000
SCALE NTS
DRAWN BY GH
APPROVED BY
TITLE RACK MOUNT OVERVIEW & CONNECTIONS
DATE 4-19-05
DRAWING NUMBER DT3000-04 REV 1
O2 CELL
TOP VIEW
COVER REMOVED
FLOW GAUGE
DT3000 OXYGEN ANALYZER
FRONT VIEW
19
7
4

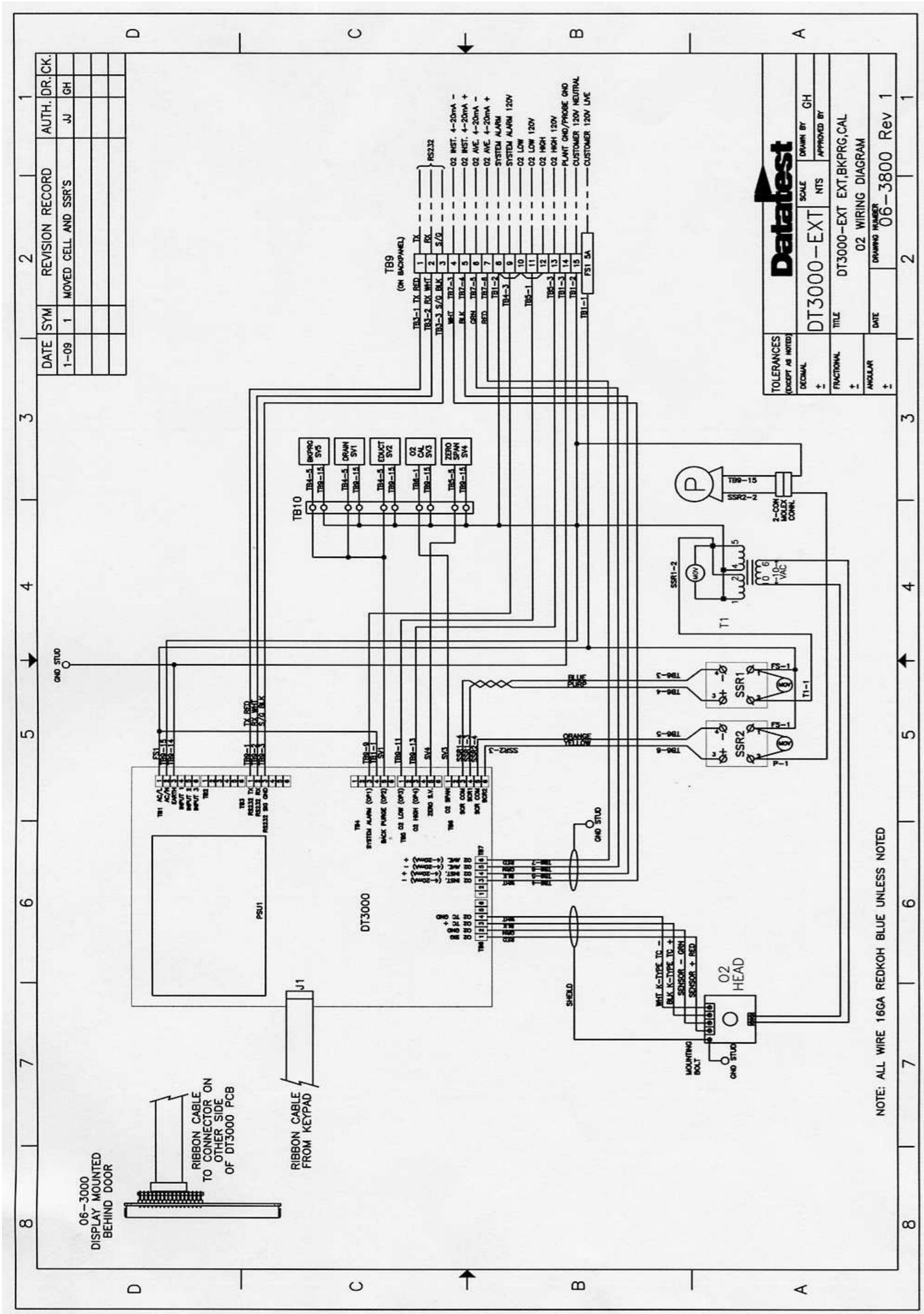

REVISION RECORD
DATE
SYM
AUTH.
DR.
CK.
06-3879-110V
06-3879-220V
DT3000-65
DT3000 CENTERED RACK MOUNT
WIRING DIAGRAM
06-3879-XXX
7-9-09
NTS
GH
TOLERANCES
EXTRACTIVE O2 ASSEMBLY
TB1
POWER MODULE
GND STUD
110V
220V
SSR
DT3000-110
DT3000-220
PSU1
J1
RIBBON CABLE FROM KEYPAD
06-3000 DISPLAY MOUNTED BEHIND DOOR
RIBBON CABLE TO CONNECTOR ON OTHER SIDE OF DT3000 PCB

Appendix IV – Drawings for Self Contained Control Unit

The reduced size drawings on the following pages are provided as typical for the specific design stated above. Larger drawings and/or electronic drawings are provided for the actual design purchased.

07-3803 Rev. 1 Analyzer Overview
06-3800 Wiring Diagram


TB9
(ON BACKPANEL)
CUSTOMER WIRING
RS232
TX
RX
S/G
O2 INST. 4-20mA -
O2 INST. 4-20mA +
O2 AVE. 4-20mA -
O2 AVE. 4-20mA +
SYSTEM ALARM
SYSTEM ALARM 120V
O2 LOW
O2 LOW 120V
O2 HIGH
O2 HIGH 120V
PLANT GND/PROBE GND
CUSTOMER 120V NEUTRAL
CUSTOMER 120V LIVE
FS1 5A
24.00
25.25
24.00
X
9.18 DEEP
18.00
ZERO
CAL GAS
O2
SPAN
CAL GAS
PLANT AIR
100 P.S.I
EXHAUST
(4X)ø0.56
MOUNTING
HOLES
SAMPLE IN
3/8" TUBE FITTING
6" NIPPLE & 2" ANSI FLANGE
SUPPLIED BY USER
(WELD NIPPLE TO STACK)
PROBE
3/8" TUBE
FITTING
12" STANDARD
LENGTH VARIES
PER CUSTOMERS
REQUEST
FLANGE
ø6.00
2" ANSI FLANGE
304 STN/STL
(4X)ø0.75
ON A
4-3/4 B.C.D.
STACK
PARTICLE
FILTER
REVISION RECORD
DATE
SYM
AUTH.
DR.
CK.
TOLERANCES
(EXCEPT AS NOTED)
DECIMAL
FRACTIONAL
ANGULAR
DT3000
SCALE
NTS
DRAWN BY
GH
APPROVED BY
TITLE
O2 ANALYZER W/EXT,BCKPRG CAL
AUTOCAL WITH PARTICLE FILTER ON PROBE
DATE
12-17-07
DRAWING NUMBER
07-3803


REVISION RECORD
MOVED CELL AND SSR'S
DT3000-EXT
DT3000-EXT EXT,BKPRG,CAL
02 WIRING DIAGRAM
06-3800 Rev 1
NOTE: ALL WIRE 16GA REDKOH BLUE UNLESS NOTED
DT3000
PSU1
TB10
TB9
SSR1
SSR2
T1
02 HEAD
RIBBON CABLE FROM KEYPAD
RIBBON CABLE TO CONNECTOR ON OTHER SIDE OF DT3000 PCB
06-3000 DISPLAY MOUNTED BEHIND DOOR