Druck

Pressure Measurement

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DPI 510
PRESSURE CONTROLLER/CALIBRATOR
SERVICE AND MAINTENANCE MANUAL
K102

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INTRODUCTION

1 GENERAL

1.1 The aim of this publication is to provide information for DRUCK SERVICE AGENTS to repair and maintain the DPI 510 Controller/Calibrator.

1.2 This publication is divided into four parts and sub-divided into chapters detailed in the table of contents.

1.3 The information in EQUIPMENT DESCRIPTION provides a detailed constructional and functional description of the DPI 510 Controller/Calibrator.

1.4 The instructions in EQUIPMENT SERVICING contain detailed routine maintenance, dismantling, inspection and assembling procedures; together with FAULT DIAGNOSIS the condition and probable cause of a malfunction can be established. The operator can carry out the recommended rectification procedures to return the instrument to a serviceable condition. After rectification, the integrity of the instrument can be verified by detailed testing and the accuracy verified by calibration.

1.5 An ILLUSTRATED PARTS LIST itemises the parts of the unit that can be replaced. It is intended for use in the provision and requisitioning of replacement parts.

SAFETY

2 This publication contains information and warnings which must be followed to ensure the safe operation and to maintain the equipment in a safe condition. Use qualified personnel and good engineering practice for all procedures and practices in this publication.

3 The operator must not use this equipment for any other purpose than that stated. This equipment is designed to be used with dry air or nitrogen in a gaseous state; do not use any other medium without first consulting DRUCK.

4 Do not apply a pressure greater than 110% of the full-scale pressure in the selected pressure range of the unit. If an excessive pressure, greater than that stated, is applied, personnel can possibly receive injures that could in extreme circumstances be lethal. Furthermore possible serious damage can occur to the instrument and the user system and equipment.

ASSOCIATED DRUCK PUBLICATIONS

K086	DPI 510 Precision Pressure Controller/Calibrator Maintenance Handbook
K086A	IEEE 488 Option Handbook
K086B	RS232 Option Handbook
K086D	Analogue Output Option Handbook
TN048	Front Panel circuit, technical description
TN049	Main PCB circuit, technical description
J100	Front Panel Assembly, test specification
J101	Main PCB Assembly, test specification
J102	Final Assembly, test specification
J118	IEEE 488 Option, test specification
J127	Analogue output Option, test specification
J133	SCM Option, test specification
TS145	RS232 Option, test specification
TS151	Barometric Option, test specification
TSTBA	Aeronautical Option, test specification

ABBREVIATIONS

NOTE: Abbreviations are the same in the singular and plural.

A	Ampere
abs	absolute pressure
AC	alternating current
atm	atmosphere
AUTO	automatic
BS	British Standard
cmHg	centimetre of mercury
cmH_2O	centimetre of water
contd	continued
DAC	digital analogue convertor
db	decibel
°C	degrees Celsius
DPI	digital pressure indicator
$'H_2O$	foot of water
FS	full-scale
HP	high pressure
HRC	high rupture capacity
Hz	Hertz
IEEE 488	Institute of Electrical and Electronic Engineers standard 488 data
inHg	inch of mercury
$"H_2O$	inch of water
Iss	issue
kg/cm^2	kilogram per square centimetre
kHz	kilo-Hertz
kg/m^2	kilogram per square metre
kPa	kilopascal
LED	light emitting diode
lbf/ft^2	pound force per square foot
LP	low pressure
mbar	millibar
mHg	metre of mercury
mH_2O	metre of water
mmHg	millimetre of mercury
MAX	maximum
mm	milli-metres
mPa	mega-Pascal
Pa	Pascal
PCB	printed circuit board
PIN	personal identification number
psi	pound force per square inch
PSU	power supply unit

ABBREVIATIONS (contd)

rev	revision
RMS	root mean square
RS232	serial data transmission standard
sec	second
SK	socket
torr	1/760 x 1 atm (1 torr = 1 mmHg)
V	volts
VA	volt ampere
VHP	very high pressure
VLP	very low pressure

LIST OF CHAPTERS

PART 1

EQUIPMENT DESCRIPTION

List of Chapters

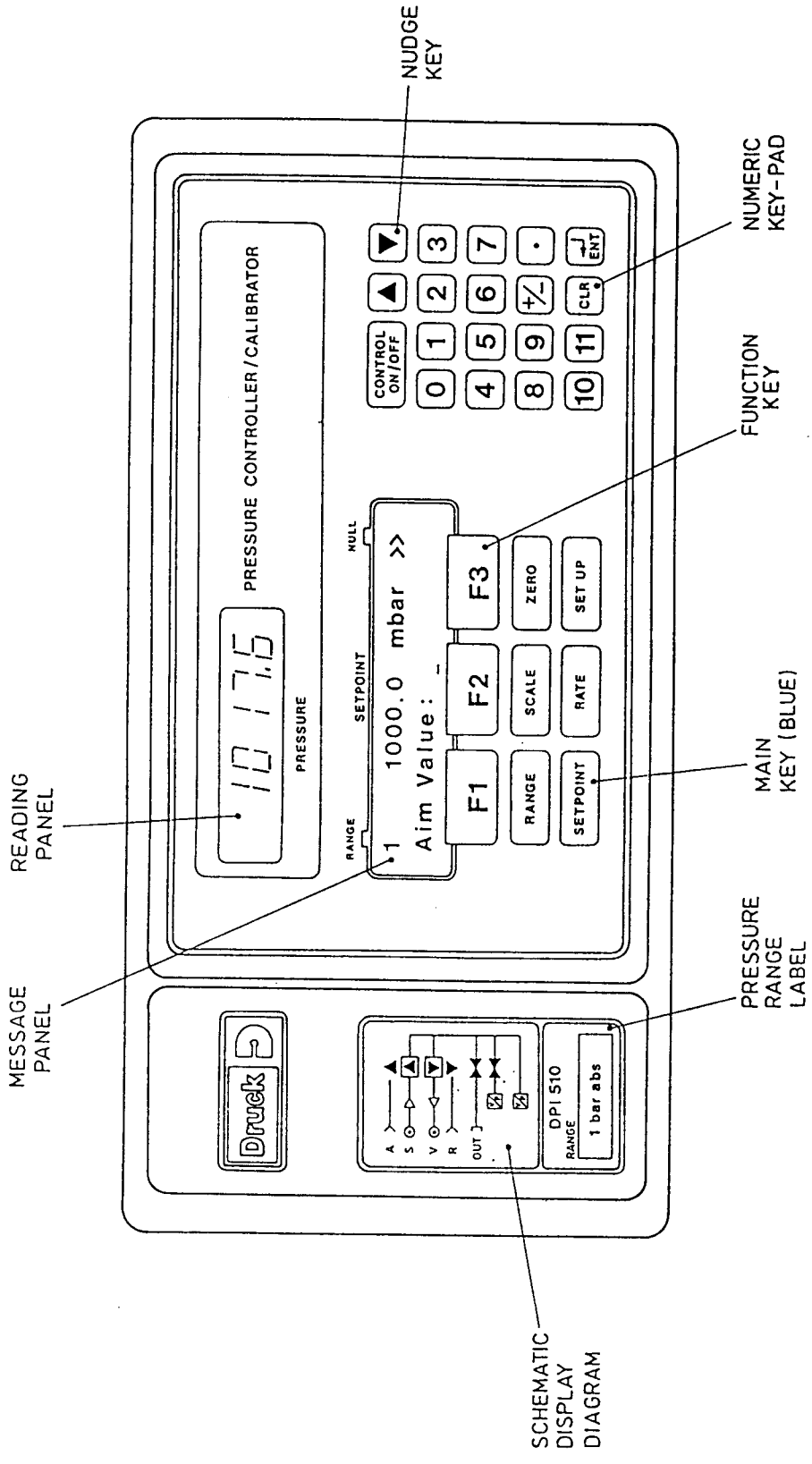

Figure 1, Front Panel

CHAPTER 1

INTRODUCTION

1 GENERAL (Figure 1)

The DPI 510 range of instruments are high accuracy, microprocessor controlled, pressure controller/calibrators with up to two integral or remote transducers providing two pressures ranges. Located on the front panel are a membrane key-pad, displays and LED indicators. The membrane key-pad comprises numeric keys, function keys and blue, main keys. The two front panel, vacuum fluorescent displays consist of a 6 digit, 7 segment reading panel to show pressure values and a 2 line, 20 character message panel. LED indicators illuminate on a schematic diagram when the control and protection valves are energized. The instrument full-scale pressure ranges are indicated on the front panel label.

The unit provides 23 programmable pressure measurement units selected from the front panel. An audible alarm will sound and a message is displayed if the unit exceeds 120% of the rated pressure. Negligible calibration change will be caused at two times the rated pressure. Dual range units have auto-protection of the LP sensor.

Optional functions are produced on a PCB which plugs into an option connector on the main PCB and provide external connectors on the rear panel. The options on plug-in PCB provide IEEE 488 or RS232 output/control, Sensor Conditioning Module and Analogue signal output. Further options on the instrument are remote transducer, rack and panel mountings, minus 1 bar measurement, barometric reference and aeronautical.

DATA

ACCURACY

NOTE: The following figures include 90 day stability and use of the auto-zero facility.

70 mbar to 70 bar range

±0.01% F.S. from 0% to 20% F.S.
±0.04% of reading from 20% to 100% F.S.

DATA (contd)

70 bar to 210 bar range

±0.02% F.S. from 0% to 20% F.S.
±0.08% of reading from 20% to 100% F.S.

Maximum resolution:	0.01% FS below 100mbar 0.005% FS over 100mbar
Controller Stability:	0.004% F.S. random variation around control value set-point

Combined Non-linearity, Hysteresis and Repeatability

NOTE: The following figures are included within the accuracy statement.

70 mbar to 70 bar range

±0.008% F.S. from 0% to 20% F.S.
±0.025% of reading from 20% to 100% F.S.

70 bar to 210 bar range

±0.015% F.S. from 0% to 20% F.S.
±0.04% of reading from 20% to 100% F.S.

THERMAL EFFECT

Calibrated temperature range:	10° to 30°C
Operating temperature range:	0° to 50°C
Thermal sensitivity of span (Zero - adjusted by key press)	≤0.002% Reading/°C (averaged over 10-30°C)

POWER SUPPLY

Voltage selection:	88 - 132V or 176 - 264V
Frequency range:	47 - 440Hz
Power Consumption:	80VA

For further information refer to the data sheet

CHAPTER 2

CONSTRUCTIONAL DESCRIPTION

1 GENERAL

1.1 The instrument is contained within a front and rear panel and two side panels. Four screws, located through holes in the rear panel, screw into threaded holes in the side panels. A further four screws similarly locate through holes in the side panel and screw into lugs in the front panel. The top and bottom covers fit on flanges of the side panels and are each secured by four screws and washers.

1.2 Six studs of the key-pad membrane secure the key-pad membrane on the outer face into the cast alloy front panel. On the inner face of the front panel casting, the protruding studs provide location for the front panel PCB. Oblong holes in the front panel casting allow for the location of the two display panels. Further holes permit the location of the LED indicators and the keys of the key-pad membrane.

1.3 Four screws secure the vacuum fluorescent message display panel to the front panel PCB and a ribbon cable assembly connects the two components. LED indicators illuminate on a schematic diagram when the control and protection valves are energized. The instrument full-scale pressure ranges are indicated on the front panel label.

1.4 Drillings and cutouts in the rear panel provide locations for the manifold assembly, power supply module, calibration enable switch, external valve control connector and the external transducer connector.

1.5 The pneumatic manifold, of the 0 - 70bar range, is drilled and tapped to receive pneumatic connection unions. Connected to the inlet, outlet, reference and vent unions are inline sintered filters. Further drillings in the body of the manifold provide airways to interconnect the solenoid operated valves with the appropriate inlet and outlet connections. An orifice plug, inserted into a threaded bore, forms the seat for each valve. Each solenoid operated valve comprises a flanged hollow tube with a fixed core in one end and a spring-loaded plunger in the other. The tube is screwed into a threaded bore of the manifold and sealed with an o-ring. The plunger, held in position by the spring, has a rubber insert in the end that bears on the valve seat. The solenoid coil is located over the tube and secured with a washer and knurled or hexagonal nut. The pressure transducer screws into the manifold and connects with the interconnecting airways. Dual range instruments contain a

second pressure transducer screwed into the manifold. An additional solenoid valve isolates the second pressure transducer from the interconnecting airway.

1.6 The Power Supply Inlet Module comprises a fuse holder, line voltage selector, switch and power supply connector contained in a moulded casing. Spring-loaded clips at each corner of the casing locate and secure the Power Supply Inlet Module in the rear panel. The "Calibration Enable" switch fits into the rear panel above the Power Supply Inlet Module and is secured by nuts, screws and washers. The two external connectors are both secured in the rear panel by locking rings. Mounting brackets, screwed onto the Power Supply Unit, secures the Power Supply Unit to the side panel.

1.7 Right-angled brackets secured by screws to the front, rear and side panels provide mounting points for the Main PCB and continuity for the earth (ground). Relays for the external valve control circuits, connectors for option PCB and all the control circuit components are located on the Main PCB.

1.8 Blanking plates, supported by a retaining bar, cover a cut-out in the rear panel. Some options are produced on PCB which plug into a standard option connector on the Main PCB and provide external connectors through the cut-outs on the rear panel. The options on plug-in PCB provide IEEE 488 or RS232 output/control, Sensor Conditioning Module, Analogue signal output, Barometric Reference and Aeronautical.

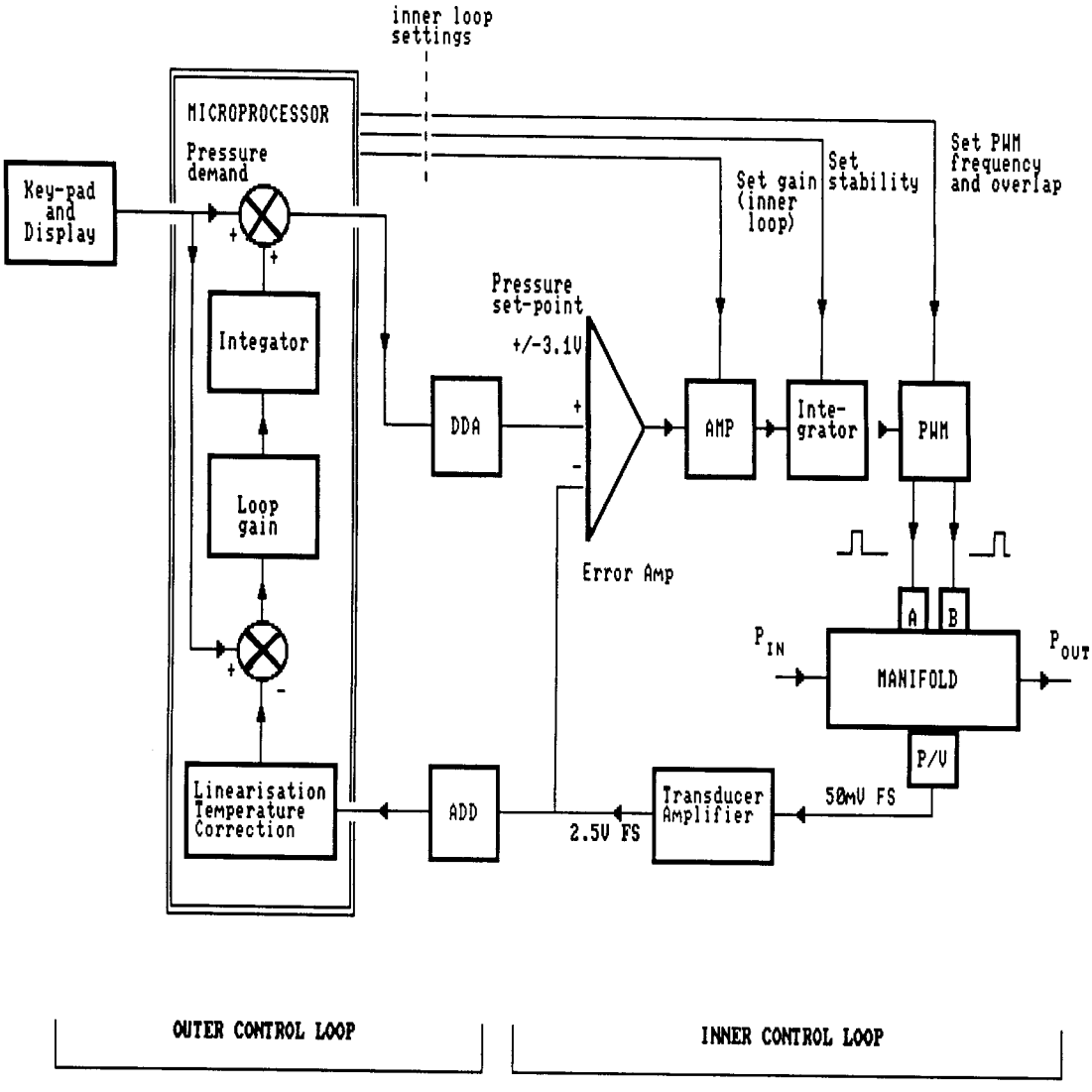

Figure 2, Dual Loop Control

CHAPTER 3

FUNCTIONAL DESCRIPTION

1 GENERAL

1.1 The instrument is a pressure control system based on the use of Pulse Width Modulated (PWM) pneumatic valves to control the flow, and hence pressure, of gas from a pressure source. A closed loop feedback control system is employed to bring the output pressure automatically to the set-point entered by the User. Two loops working at differing rates are used to bring the output pressure quickly and accurately to the set-point. The 'inner' loop is implemented in analogue circuitry and has a fast response time, whilst the 'outer loop' is implemented digitally and is slow but more accurately calibrated.

2 INNER CONTROL LOOP (Figure 2)

The load pressure is controlled by regulating the gas flow into and out of the load using two electrically operated pneumatic valves. One valve allows flow from the pressure source to the load and is termed the Apply valve. A second valve is opened when the pressure in the load is to be reduced, this is termed the Release valve. In order to achieve fine control of the load pressure and to linearize the flow characteristics of the valves, the valves are energized by a pulse train whose pulse width is varied in order to control the flow.

2.1 A transducer mounted on the manifold to measure the load pressure feeds its millivolt level signal to a differential amplifier where zero and span are adjusted to give a full-scale of 2.50 V. This is the uncorrected or 'raw' pressure signal which drives the 'inner loop', and is subtracted from the set-point pressure in the Error Amplifier. Inner Loop Gain and Stability or damping factor are set from the processor by the two following stages. The resulting processed error signal drives the Pulse Width Modulator which pulses open either the Apply or Release valve according to the polarity of the error.

2.2 The negative feedback loop is thus closed and the loop will strive to reduce the error signal to zero. It will achieve this at a rate determined by the integrator time constant and the overall gain of the loop. The higher the gain, the lower the residual error when the controller has settled. Too low a value of stability will produce an under-damped oscillatory response, too high a value will give an unacceptably long time to reach the set-point. Adjusting the pulse Frequency enables the optimum operating point of the valves to be achieved and is related to the natural resonant frequency of the valve plunger assembly. Overlap is an important feature in linearizing the relationship between error

voltage into the PWM and flow rate through the valves. It is similar to the bias current applied to a push-pull output stage to overcome non-linearities at zero input often termed 'cross-over distortion'. As overlap is increased the current pulse to each valve is increased below the threshold at which the valve actually opens.

2.3 Increased overlap gives increased controllability as the cross-over non-linearity is removed. Too much overlap will result in the valves actually allowing gas to pass even when the error signal is zero. This produces and undesirable constant noise from the valves and dissipates gas from the source to no effect.

2.4 Final controller constants can only be derived by experiment on individual instruments. Starting values are given in the main test specification J102. Although the basic transducer calibration factors of initial zero offset and FSD have been compensated in the transducer amplifier, the gain and off-set throughout the inner loop are uncorrected. As a result, the actual pressure achieved will be in error of the true pressure by the transducer error plus the loop error. This error can be up to 0.5 %. To achieve the full instrument accuracy a fully compensated outer loop is employed to correct the final pressure value.

3 OUTER CONTROL LOOP (Figure 2)

The 2.50 V transducer full-scale signal is converted to a digital signal with a resolution of 17 bits which can be read by the main processor. At calibration time, with known pressures applied, the transducer output is measured. This process is repeated for various temperatures. A compensation map is thus created in the processor memory which can compensate for transducer non-linearity and for temperature shift. A measurement system is produced which has an accuracy of typically 0.04% of reading over the quoted temperature range. This superior measuring system is then used to close a second control loop termed the Outer Loop. This loop is implemented in software within the main processor and consists of the precision measuring system an adjustable gain amplifier and an integrator. The output of the integrator is added to the set-point signal of the inner loop so as to correct for the errors of the inner loop. The rate of integration in the outer loop is several times greater than the integrator of the inner loop. This difference means that when a new set-point is applied to the system the inner loop will respond rapidly to the demand and will quickly reduce the error between demand and actual pressure to the error band of the inner loop. As the inner loop settles the outer loop starts to respond to the diminished error and over a period of some seconds the error is further reduced to the error band of the outer loop. The work load is split between the loops in this manner so as to avoid the requirement for extremely high data processing rates that would be required to produce a digital loop with the response time of the analogue loop.

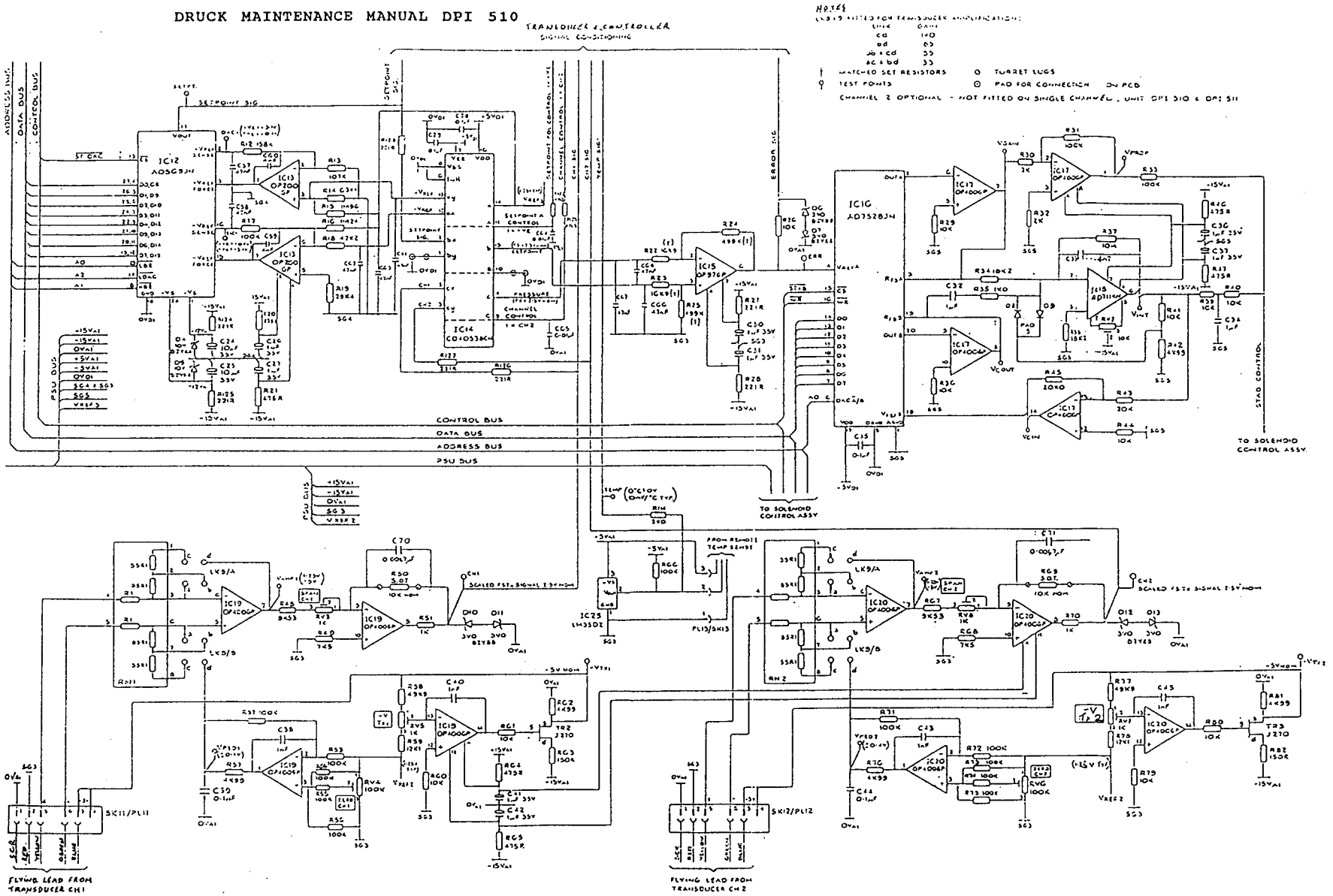

Figure 3, Transducer and Control Signal Conditioning

4 CIRCUIT DESCRIPTION, MAIN BOARD (Figure 3)

4.1 Transducer and Control Signal Conditioning

4.1.1 Transducer Interface

Two transducers may be fitted to the valve assembly enabling the instrument accuracy to be maintained over a larger range than a single transducer. The Druck transducer employed has a piezo-resistive bridge bonded to a silicon diaphragm. The bridge must be energized from a regulated voltage and this is generated by IC19. A -5 V regulated rail for the bridge is derived from the -15 V supply rail via the FET TR2 as a series pass element. Gate potential is controlled by the output of the amplifier IC19 which acts as a comparator between Vref and a sample of the -5 V as set by RV5. With the high open loop gain of this circuit the -5 V is accurately related to the stable 1.2 V of Vref. Precise setting of the rail is achieved by RV5. R63 offers short-circuit protection by current restriction and reduces dissipation in TR2. The circuit is repeated for the range 2 transducer.

A differential amplifier IC19 processes the output from the transducer bridge. A wide range of transducer full-scale voltage outputs must be accommodated. Resistor network RN1 allows the gain of the first stage to be adjusted whilst the impedance of each input remains equal. The ground return for the non-inverting input can be adjusted either side of zero (+/- 0.4 V) by RV4 via link LK8/B. This allows the transducer zero offset to be nulled. A second stage of amplification IC19 gives further gain adjustment. R50 again adjusts for transducer full-scale whilst RV3 allows trimming of full-scale. Zener diodes limit the output swing to +/- 3.0 volts. At this point the transducer output has been normalized to 2.50 V.

In order to monitor the transducer temperature as accurately as possible a temperature sensing IC is mounted in the thermal break to the transducer. The voltage output of this device feeds onto the main PCB via PL/SK13.

4.1.2 Range Selection

IC14 is an analogue switch. Under processor control section c of IC14 selects either range 1 or range 2 signal conditioning output as the feedback signal for the inner loop.

4.1.3 Inner Loop Set-Point Generation

The processor writes the set-point value to the digital to analogue converter (DAC) IC12. This is a sixteen bit convertor on an 8 bit bus and thus the value is written in two successive bytes. In order to allow a negative set-point (for negative pressure generation) without reducing the 16 bit accuracy IC13 allows the reference voltage to the convertor to be reversed. Section (a) of IC14 directs the Vref reference source to switch the set-point polarity under processor control.

4.1.4 Inner loop Error Amplifier

Section (b) of IC14 passes the set-point signal to the error amplifier IC15. This switch section is permanently set and is only placed in the set-point signal path to compensate for drift in the similar switch section in the pressure signal path. Thus the actual pressure feeds the inverting input of IC15 via section (c) of IC14 and the set-point feeds the non-inverting input.

4.1.5 Programmable Gain Amplifier

The amplified error signal at the output of IC15 feeds the reference input of section (a) of the 8 bit multiplying DAC IC16. When an 8 bit value is entered into the DAC by the processor the internal resistor ladder is set which determines the feedback level around IC17 and thus its gain. A fixed gain section (x 50) follows giving a signal termed 'Vproportional' which is summed via a 100 kohm resistor with the signal from the integrator described below.

4.1.6 Programable Integrator

IC18 is an integrator whose rate of integration is determined by the value of C32 and the gain of the two sections of IC17. This gain is controlled by an 8 bit code written into section (b) of IC16. D8 and D9 form a soft limiter restricting the output swing of IC18 to around +/- 3 V. The error signal feeds into the integrator after the programmable gain via R34. The integrator output feeds through a low pass filter R39/40 and C34 before being summed with the proportional signal.

5 SOLENOID CONTROL (Figure 3)

5.1 Pulse Width Modulator

A saw-tooth waveform is generated within IC24 whose slope is determined by C47. Two voltages are set (2v delta + and 2v delta -) from IC21 section (a) and following amplifiers which determine the amplitude of the saw-tooth. The saw-tooth is summed with the output of the error processing circuit so as to shift the whole waveform relative to zero volts. A second pair of voltages set by IC21 section (b) set switching thresholds in IC24. When the saw-tooth rises above +Vt output A goes to logic one. When the saw-tooth goes below - Vt output B goes to a logic one. The A and B outputs feed via current amplifiers TR14 and TR15 to the Apply and Release solenoid valves on the valve manifold.

Thus with the amplitude and switching thresholds constant a positive error signal causes the saw-tooth to move positive relative to Ov and thus to spend a greater portion of its time above +Vt. This increases the on period of the A output and allows more gas to flow to the load via the Apply solenoid valve. Simultaneously the positive movement decreases the period the saw-tooth spends below the -Vt threshold and the Release valve turns off. In this way the feedback loop is closed and the controller will reduce the error signal to zero.

5.2 Valve Drive Frequency

Via IC21 the processor can adjust the saw-tooth amplitude. As the slope is fixed this has the effect of controlling frequency giving front panel control of valve drive frequency.

5.3 Valve Drive Bias

By increasing the voltage between +Vt and -Vt from 2v delta downwards a bias or 'overlap' can be applied to the control valves. If the thresholds and saw-tooth amplitude are identical then the valves will only open when the error voltage has a value greater than zero. However in order to linearize the Voltage/Flow characteristic of the PWM and valve module it is desirable that the valves are constantly energized with a pulse whose width is just less than that required to open the valve when the error is zero. Any deviation from zero error is then linearly converted into a change of flow without the need to overcome friction in the valve. IC21 section (a) and the following amplifiers enable the processor to set Vt between 1.5 and 4 V depending on the overlap required.

6 OUTER LOOP (Figure 3)

Changes in set-point or load demands cause an increase in error signal to which the inner loop quickly responds. However by design the inner loop has a number of uncorrected errors which mean that when the loop settles there will be an error between the actual and demanded pressure. The outer loop monitors the inner loop and cancels these errors.

The outputs from IC19 and IC20, the normalized transducer signals, are fed to a multiplexer IC11. The desired signal is selected and passed to the precision A to D convertor IC10. IC10 is controlled by the processor and the value of the transducer signal is read in as a sixteen bit value.

At calibration time a map of the transducer characteristics is stored and this is now used to correct the non-linearity and temperature shifts of the transducer to the full accuracy of the instrument. The accurate pressure is compared with the demanded pressure and any error is amplified and integrated before being introduced into the set-point of the inner loop. Working through the inner loop, the outer loop now brings the output to the set-point at maximum accuracy. Interaction between the two loops is minimised by the differing integration rates, the outer loop being much slower to respond than the inner loop.

7 MAIN PROCESSOR (Figure 3)

The processor and associated software allow a range of functions to be selected and supervise the routine of measurement control and communications. A 6303-YP 8 bit micro-controller is employed on the main PCB. Memory is byte wide, 8k RAM, 32k EPROM, 2k EEPROM, and 8k Software Option EPROM. Each plug-in option card also has its own memory space. Memory decoding is performed by IC6 and 7. The Calibration switch enables write access to all of the EEPROM. During normal operation only a part of the EEPROM can be written to. This arrangement protects calibration values stored in the EEPROM. Calibration mode is indicated to the processor using one of the I/O ports (P62). Port P26 selects the set-point polarity whilst P63 selects the input channel (transducer). Ports P20, 21 and 27 handshake with the A to D convertor. P27, 21 set the A to D mode whilst P20 conveys the comparator output to the processor. Ports P52-54 select the input to the A to D via multiplexer IC11. Ports P64-67 operate the isolation, protection and roughing valves via the solenoid drivers. Roughing valves, if used, are mounted externally to the instrument and are driven by volt free contacts on relays RL1 and RL2. P25 turns off the drive to the Apply and Release valves when the 'Controller On/Off' key is pressed. Ports 23 and 24 are data input and outputs to the front panel assembly. They are driven to simulate an RS232 serial link but using 5V signalling levels. The signalling rate is 1200 baud.

A 4 MHz crystal is used for the processor clock oscillator which gives a 1 MHz bus clock rate. NMI is not used but IRQ1 and IRQ2 are available to the plug in options.

In the event of power supply disconnection or failure, a signal PFAIL (power fail) is issued by the power unit prior to the collapse of the supply rails. This forces the processor into reset and also drives all of the valves to there de-energized positions (all closed). At power-up the processor is forced into the reset mode until the rails are settled and PFAIL is high.

NOTE: The PFAIL signal is an active low.

8 FRONT PANEL ASSEMBLY (Figure 3)

The User interface function of the front panel consists of a membrane keyboard for control and data entry, a numeric display for pressure and other measured data, a two line 20 character alpha-numeric display and six individual LED. These are controlled by a second 6303 processor and communicate to the main PCB using a bi-directional serial link. IC5 is a high current driver and high noise immunity receiver for this link.

NOTE: This is a 6303XP and must not be changed with the 6303YP on the main PCB.

The keyboard switch matrix is scanned by the processor and corresponding ASCII characters are sent to the main board after each key depression. A sounder can be activated by P67 of the processor via a driver stage TR2.

The 2 x 20 character vacuum florescent dot matrix display assembly is interfaced to the data bus with simple address decoding via IC4. VFD1 is a 7 segment numeric vacuum florescent display. IC2 is the segment driver and has a serial input from the processor. A voltage convertor CU1 converts the 5V supply to the voltages necessary to drive the numeric display. Low voltage AC is produced to drive the display heaters, and HT of -26 and -30.5V are used to energise the acceleration electrodes. A further rail VDD of -10V is derived by R1 and D2. TR1 converts the voltage levels from the processor port to the Power On Reset (POR) input of IC2. LED 1-6 are individual LED driven by the solenoid drivers on the main board. IC3 is an 8k byte EPROM and contains the operating software for the front panel assembly.

9 POWER SUPPLY AND DISTRIBUTION

DC supply rails are derived from the incoming power supply by a power unit module. The DC rails are:

a. +15V @ 0.25 A regulated
b. -15V @ 0.25 A regulated
c. + 5V @ 2.0 A regulated
d. +24V @ 2.0 A semi-regulated

The power supply unit is not a repairable item and should be exchanged complete. The main board incorporates a precision reference device D3 which gives a highly regulated reference supply of 1.2 V.

Power is distributed throughout the instrument by multiple supply busses and multiple earth returns. Grounds are categorized as 'analogue' those associated with power to analogue processing elements, 'signal' those associated with analogue signals, and 'digital' grounds associated with power supplies to logic (generally +5 V returns). All supplies of a particular category are returned to a common point on the Main PCB before connecting to the PSU via the cable assembly.

PART 2

EQUIPMENT SERVICING

List of chapters

CHAPTER 1

INTRODUCTION

1 GENERAL

1.1 Routine maintenance is carried out to ensure that the equipment remains in a serviceable condition.

1.2 To determine the extent of dismantling required, refer to FAULT DIAGNOSIS. This will establish the condition of the equipment or the most probable cause of its malfunction.

1.3 A static safe work area with appropriate equipment. Absolute cleanliness of the work area, tools and equipment must be observed at all times.

2 SPECIAL TOOLS AND MATERIALS

NOTE: Equivalent substitutes may be used.

2.1 The following special tools are required.

Equipment	Usage
deep 13mm socket	dismantling/assembling
deep 22mm socket	manifold valves

2.2 The following materials are required.

Material	Specification	Usage
Foam cleaner	-	Cleaning
Lint-free cloth	-	Cleaning
White spirit	BS245	Cleaning
Freon	PCB standard	Cleaning
Loctite	Grade 222	Assembling

3 WIRING DATA LIST

3.1 Power Input Lead Sub-assembly

Wire	Colour
Live	brown
Neutral	blue
Earth (Ground)	green/yellow

3.2 FURTHER WIRING DETAILS TO BE ISSUED LATER.

CHAPTER 2

WARNINGS AND CAUTIONS

1 WARNINGS

1.1 WHEN USING FOAM CLEANER, DO NOT TO BREATHE THE FUMES OR ALLOW UNDUE CONTACT WITH THE SKIN. FOAM CLEANER MUST BE USED IN A WELL VENTILATED AREA, AWAY FROM NAKED FLAMES.

1.2 VOLTAGES IN EXCESS OF 30 VOLTS (RMS) OR 50 VOLTS DC CAN, IN CERTAIN CIRCUMSTANCES BE LETHAL. WHEN WORKING ON SYSTEMS REQUIRING EXPOSURE TO LIVE, UNPROTECTED CONDUCTORS, A SECOND PERSON IS ALWAYS TO BE IN ATTENDANCE.

1.3 WHEN USING WHITE SPIRIT, DO NOT EAT, DRINK OR SMOKE. AVOID BREATHING VAPOUR, FUMES, GAS OR SPRAY. USE IN WELL VENTILATED AREAS. APPLY BARRIER CREAM.

1.4 WHEN USING FREON, DO NOT EAT, DRINK OR SMOKE. DO NOT BREATHE FUMES, VAPOUR, GAS OR SPRAY. FREON MUST BE USED IN A WELL VENTILATED AREA.

1.5 WHEN USING TEST EQUIPMENT, ENSURE THAT IT IS SERVICEABLE. IT SHOULD COMPLY WITH STATUTORY REGULATIONS AND IT SHOULD COMPLY WITH STIPULATED TEST PERIOD REQUIREMENTS.

2 CAUTIONS

2.1 THE PCB IS FITTED WITH CMOS STATIC SENSITIVE DEVICES. HANDLE WITH CARE AND OBSERVE THE APPROPRIATE PRECAUTIONS.

CHAPTER 3

ROUTINE MAINTENANCE

1 GENERAL

1.1 The purpose of this chapter is to specify routine maintenance and its periodicity to maintain the unit in a fully serviceable condition.

1.2 The recommended period of servicing is based on a temperate environment. If the unit is used in an environment with higher humidity or higher levels of dust the periodicity must be increased accordingly. Consult the manufacturer if there is any doubt.

2 EXAMINATION

2.1 Examine externally for damage, distortion and corrosion.

2.2 Examine the rear panel fixed connectors for loose, bent or broken pins.

2.3 Examine the cable sub-assemblies for cuts, breaks or damage to the insulation. Examine the connectors for loose, bent or broken pins.

2.4 Discard all o-rings and bonded seals removed during dismantling.

2.5 Examine pneumatic equipment fittings and connections for damage,distortion and corrosion.

3 CLEANING

WARNINGS 1.1 and 1.3 are applicable to the following operation.

3.1 Clean the front and rear panel with lint-free cloth and mild detergent. Remove any stubborn dirt using foam cleaner and allow to dry.

3.2 Clean the connectors with a soft brush. Remove any stubborn dirt using white spirit and allow to dry.

3.3 Remove the filter sub-assembly as detailed in paragraph 5. Using compressed air remove any dust or debris.

3.4 Replace the filter element if dust or debris cannot be removed.

3.5 Refit the filter sub-assembly as detailed in paragraph 5.

4 MAINTENANCE

4.1 Carry out the following operations at the specified periods :

Component	Operation	Period	Paragraph
Filter element	Replace	12 months	5
Valve sub-assembly	Clean	6 months	6
Unit	Calibrate	6 months	7

5 FILTER

5.1 To replace the manifold filters proceed as follows:

a. Unscrew and remove the vent silencer from the VENT connection port.

b. On very low pressure units, unscrew and remove the reference diffuser from the REFERENCE connection port.

CAUTION: **Ensure that the screwdriver does not damage the threads in the bore of the connection ports.**

c. Using a screwdriver, carefully unscrew and remove each filter plug and filter from the bores of the connection ports.

CAUTION: **Do not over-tighten the filter plug, the filter will be crushed.**

d. Position the unit with the rear panel inclined at less than 45° towards the work surface. Carefully insert the new filter and filter plug into each bore of the manifold.

e. Using a screwdriver, carefully screw each filter plug into the bore of the manifold. Check that the filters are correctly located, the filters can be seen through the centre hole of the filter plugs.

5.2 The vent silencer, on all units, and reference diffuser, on very low pressure units, should be inspected when the components are suspect.

a. Unscrew and remove the vent silencer form the vent connection port.

b. Inspect the element for cleanliness and, if necessary, replace.

c. On very low pressure units, unscrew and remove the reference diffuser from the reference connection port.

d. Inspect the element for cleanliness and, if necessary, replace.

6 VALVE SUB-ASSEMBLIES

NOTE: The following procedures are for 0 - 70bar range instruments.

6.1 Unscrew and remove the four screws and washers. Remove the top cover.

6.2 If necessary, remove the manifold assembly for access as detailed in DIS-MANTLING, Chapter 4.

6.3 Unscrew the knurled nut 0 -10bar, 19mm hex nut 0 - 70bar, 19mm hex on LPP and ISOL solenoids securing the solenoid to the valve tube and collect the washer. Withdraw the solenoid and restrain the solenoid and cables.

6.4 Carefully unscrew and withdraw the valve sub-assembly from the manifold. Remove the plunger and spring from the bore of the valve tube.

NOTE: Avoid separating the plunger and spring. If the plunger and spring are separated ensure that they are identified and matched on assembly.

6.5 Inspect the plunger and spring for wear, corrosion and cleanliness. Ensure that the insert in the end of the plunger is free of dirt and that the face is not damaged. Any signs of contamination could indicated that the user system requires servicing, refer to the manufacturer's instructions.

NOTE: The face of the insert will have an even, circular, indent made by the valve seat. Any further marks or indentations will cause control instability, a damaged insert must be replaced.

6.6 Inspect the valve seat for damaged and ensure that it is free from dirt.

6.7 Using Freon, clean the valve plungers and tubes.

6.8 Fit a new o-ring to the valve tube. Locate the plunger and spring in the bore of the tube, insert end trailing, and screw the assembly into the manifold.

6.9 Refit the solenoid over the valve sub-assembly and secure with the washer and knurled nut.

6.10 Repeat operations 6.2 to 6.7 for each valve sub-assembly.

6.11 If necessary, refit the manifold assembly as detailed in ASSEMBLING, Chapter 6.

6.12 Refit the top cover and secure with the four washers and screws.

6.13 On completion of assembling operations, refer to Chapter 7 for testing.

7 CALIBRATION

7.1 When the testing detailed in Chapter 7 has been satisfactorily completed, carry out a calibration as detailed in Chapter 8.

8 FURTHER MAINTENANCE

8.1 No further maintenance procedures are required unless a fault in the unit occurs, refer to PART 3 FAULT DIAGNOSIS. The dismantling and subsequent assembling of components for maintenance are detailed in Chapters 4 and 6 respectively. Reference is made to the appropriate chapter and paragraph for these operations and the subsequent testing and calibration which are detailed in Chapters 7 and 8.

CHAPTER 4

DISMANTLING

1 GENERAL

1.1 The purpose of this chapter is to detail the extent of dismantling procedures and must be used in conjunction with FAULT DIAGNOSIS in Part 3.

1.2 Preparation

1. Disconnect the power supply from the unit.

2. Unscrew and remove the four screws and washers. Remove the top cover. If necessary, repeat for the bottom cover.

1.3 Power Supply Inlet Module and Cable Assembly

1. Remove the nut and washers securing the earth (ground) connections to the stud.

2. Note the position of the cables connected to the power supply module. Using a small screwdriver, unclip the power supply module.

3. Carefully pull out the power supply inlet module and disconnect the cables.

1.4 Power Supply Unit

1. Disconnect the output connector from the main PCB.

2. Disconnect the PSU cables from the Power Supply Inlet Module. If necessary, remove the Power Supply Inlet Module for access as detailed in 1.3.

3. Hold the PSU to prevent damage to the main PCB, unscrew the four screws securing the PSU mounting bracket to the side brackets and lift out the PSU. Collect the four washers.

4. Unscrew and remove the four screws and separate the two mounting brackets from the PSU. Collect the four washers.

1.5 Manifold Assembly

1. Disconnect the transducer connectors and the solenoid connector from the main PCB and temperature sensor connector.

2. Hold the Manifold Assembly to prevent damage to the main PCB, unscrew the four screws securing the manifold assembly to the rear panel. Collect the four washers.

3. Note the position of the terminals connected to the solenoids of the manifold assembly. Disconnect the cables from the solenoids.

4. Secure the Manifold Assembly and, using a spanner, unscrew and remove the pneumatic connection unions. Collect the bonded seals. Carefully remove the sintered filter from each port of the Manifold Assembly.

5. Secure the Manifold Assembly, unscrew and remove the transducer and collect the bonded washer. For dual range instruments repeat the operation for the second transducer.

6. Secure the Manifold Assembly, unscrew the solenoid retaining nuts and remove the solenoids.

7. Secure the Manifold Assembly, unscrew and remove each valve sub-assembly.

1.6 Display Assembly (Front Panel PCB)

1. Disconnect the ribbon connectors PL1 and PL2 from the Display Assembly.

2. Unscrew and remove the screw securing the right-angled bracket to the Front Panel Assembly.

3. Unscrew and remove the four screws securing the Front Panel Assembly to the side panels.

4. Unscrew and remove the six nuts and washers securing the Display Assembly (Front Panel PCB) to the Front Panel Assembly.

5. Disconnect ribbon connector PL3 from the Display Assembly (Front Panel PCB) and remove.

6. Collect the six spacers from the studs of the key-pad membrane.

1.7 Module (Message Panel)

1. Disconnect the ribbon connectors PL4 and SK6 from the Display Assembly (Front Panel PCB).

2. Unscrew and remove the four screws and washers, separate the Module (Message Panel) from the Display Assembly (Front Panel PCB).

1.8 Membrane Key-pad

1. Carefully separate the Membrane Key-pad from the front panel casting.

CHAPTER 5

CLEANING AND INSPECTION

1 PROCEDURE

To enable a component to be visually inspected for damage and signs of malfunction, each component must be thoroughly cleaned using the appropriate cleaning agents and methods.

WARNINGS 1.1 and 1.4 are applicable to the following operations:

1.1 Cleaning

1.1.1 Using foam cleaner and a soft brush, remove any dirt or debris from the removed component or the unit.

NOTE: All new components should be cleaned before fitting.

1.2 Inspection

1.2.1 Examine the unit generally for signs of corrosion and damage.

1.2.2 Examine the wiring for signs of overheating, damaged insulation and security. Ensure that insulating sleeves are correctly positioned.

1.2.3 Examine the terminals of electrical components for security of attachment and signs of damage.

2 PRINTED CIRCUIT BOARDS

2.1 Cleaning

2.1.1 Immerse the printed circuit board in a bath of Freon and brush using a soft brush.

2.1.2 Immerse the printed circuit board in a bath of clean Freon, remove and allow to dry.

2.2 Inspection

CAUTION 2.1 applies to the following operation:

2.2.1 Examine the printed side of the printed circuit board for signs of cracks and corrosion.

2.2.2 Ensure that the printed circuits are firmly bonded to the boards over the complete area.

2.2.3 Examine the connector mounting nuts for security of attachment. Ensure that the connector pins are clean and show no signs of distortion or corrosion.

2.2.4 Examine all electronic components for signs of overheating, good solder joints and security of attachment.

CHAPTER 6

ASSEMBLING

1 GENERAL

1.1 Ensure all parts are clean prior to assembly.

1.2 Absolute cleanliness of the work area, tools and equipment must be observed at all times.

1.3 Wiring must conform to the wiring data list.

1.4 After assembling the unit must be tested in accordance with Chapter 7 and if necessary, calibrated in accordance with Chapter 8.

2 PROCEDURE

CAUTION 2.1 is applicable to the following operations.

Using the special tools, equipment and materials specified, assemble the unit as follows:

2.1 Membrane Key-pad

1. Carefully locate the studs of the Membrane Key-pad into the holes of the front panel casting.

2.2 Module (Message Panel)

1. Locate the Module (Message Panel) on the Display Assembly (Front Panel PCB) and secure with the four washers and screws.

2. Connect the ribbon connectors PL4 and SK6 to the Display Assembly (Front Panel PCB).

2.3 Display Assembly (Front Panel PCB)

1. Locate the six spacers onto the protruding studs of the Membrane Keypad. Locate the Display Assembly (Front Panel PCB) onto the protruding studs and secure with the six nuts and washers.

2. Connect the ribbon connector PL3 to the Display Assembly (Front Panel PCB).

3. Locate the assembled Front Panel on the side panels of the instrument. Align the holes and secure the Front Panel Assembly to the side panels and right-angled bracket with the screws and washers.

4. Connect the ribbon connectors PL1 and PL2 to the Display Assembly (Front Panel PCB).

2.4 Manifold Assembly

1. Secure the Manifold Assembly, fit a new o-ring and screw each valve sub-assembly into the manifold.

2. If necessary, fit a new o-ring and screw the transducer into the manifold. For dual range instruments repeat the operation for the second transducer.

3. Locate the solenoids over the respective valve sub-assemblies and secure with the solenoid retaining nuts.

4. Carefully fit, in turn, a new sintered filter into a port of the Manifold Assembly. Locate a new bonded seal onto each pneumatic connection union and screw into the Manifold Assembly. Secure the Manifold Assembly, using a spanner, tighten each pneumatic connection union.

5. Position the assembled manifold on the rear panel of the instrument and secure with the four screws and washers.

6. Connect the transducer cables and solenoid cables to the main PCB and temperature sensor cable.

2.5 Power Supply Unit

CAUTION: Ensure that the correct length screws are fitted to the mounting brackets.

1. Fit the two mounting brackets to the PSU and secure with the four screws and washers.

2. Carefully position the PSU and secure to the side panel with the four screws and washers

3. Connect the output connector to the Main PCB and connect the PSU cables from the Power Supply Inlet Module.

4. If necessary, fit the Power Supply Inlet Module as detailed in 2.6.

2.6 Power Supply Inlet Module

1. Connect the cables to the Power Supply Inlet Module and to the PSU.

2. Locate the Power Supply Inlet Module in the rear panel of the instrument.

3. Connect the earth (ground) cables to the stud and secure with the nut and washers.

4. Secure the cables, where necessary, with tyraps.

2.7 Completion

1. Ensure that all cables are correctly routed and, where necessary, secure with tyraps. Ensure that all earth (ground) points are connected.

2. Fit the top and bottom covers and secure with the screws and washers.

CHAPTER 7

TESTING

1 GENERAL

1.1 The following tests should be carried out whenever it is necessary to establish serviceability. The tests, together with Fault Diagnosis, should indicate the extent of any dismantling.

2 EQUIPMENT

2.1 The following test equipment is required and must be used as directed.

NOTE: Equivalent substitutes may be used.

Part No	Description	Usage
-	Multimeter (0 to 20 Mohm)	Test continuity
-	Insulation resistance tester	Test insulation resistance
-	Digital voltmeter (DVM) ±0.008% RDG	Test
-	Pressure standard calibration equipment (AIR) 0 to 70bar (accuracy ±0.01%) 0 to 210bar (accuracy ±0.015%)	Test

3 TESTING THE UNIT

WARNING 1.5 applies to the following operation.

1. Blank the OUTLET connection port.
2. Switch on the instrument.
3. Select a set-point of the full-scale value of the instrument.
4. Select CONTROL on and ensure that the instrument controls to the set-point value.
5. Select a set-point of ambient pressure and ensure that the instrument controls to the set-point value.
6. Select CONTROL off and switch the instrument off.
7. Remove the blank from the OUTLET connection port.
8. Connect the OUTLET connection port.

4 TESTING ASSEMBLIES AND OPTION PCB

The procedures for testing assemblies and option PCB are contained in the following test specifications:

J100	Front Panel Assembly, test specification
J101	Main PCB Assembly, test specification
J102	Final Assembly, test specification
J118	IEEE 488 Option, test specification
J127	Analogue output Option, test specification
J133	SCM Option, test specification
TS145	RS232 Option, test specification
TS	Aeronautical Option, test specification
TS	Barometric Option, test specification

CHAPTER 8

CALIBRATION

1 GENERAL

1.1 If the accuracy of the instrument is suspect or at regular intervals a calibration check should be carried out. The instrument is calibrated by operating the CALIBRATION ENABLE switch on the rear panel, calibration data is entered via the front panel. The calibration memory is over-written if new calibration values are accepted in CALIBRATION mode. It is recommended that calibration is carried out by the supervisor or an equivalent responsible person. To prevent inadvertent or illegal entry of calibration data the PIN (Personnel Identification Number) protects the calibration memory.

NOTE: The transducer in the barometric option is density sensitive, dry air must be used in calibration to ensure constant accuracy. It is further recommended that for all calibration procedures dry air is used.

2 EQUIPMENT

2.1 The following equipment is required and must be used as directed.

NOTE: Equivalent substitutes may be used.

Description	Usage
Pressure standard calibration equipment (AIR) 0 to 70 bar (accuracy ±0.01%) 0 to 210 bar (accuracy ±0.015%)	Calibration

2.2 Test Environment

Temperature: 20°C
(Recommended)

In standard humidity and atmospheric pressure.

2.3 Procedure

Refer to J102 Final Assembly, test specification.

PART 3

FAULT DIAGNOSIS

List of Contents

FAULT DIAGNOSIS

1 GENERAL

1.1 The following procedures are to be used in conjunction with the testing detailed in Part 2 Chapter 7 and should indicate the most probable cause of the defect and the recommended rectification.

1.2 The replacement of components referred to are detailed in Part 2 Chapters 4 and 6, dismantling and assembling respectively.

2 PROCEDURE

2.1 The error codes that can be displayed by the unit are referenced to the Operation and Maintenance Handbook.

2.2 The fault diagnosis procedures are given in the following fault finding operations. Any defect arising must be rectified before proceeding to the next operation.

3 Error Codes

The following error codes can be displayed, references are made to the Operation and Maintenance Handbook.

Code	Error	Remedy
"Err001"	Over-pressure	Reduce set-point demand, vent the unit as required.
"Err002"	Lock mode on	Unlock
"Err003"	Pressure too high for range	Reduce SOURCE pressure for current selected range. Vent pressure locked in manifold.
"Err004"	Set-point out of limits	See SET-UP.
"Err005"	Manual Zero is disabled	See SET-UP.
"Err006"	Zero reading in progress	Wait for the zero function to finish.
"Err007"	Zero error too large, (Zero off-set exceeds 5% of preset limit)	Ensure system is correctly vented. Cycle power switch (off/on) and zero again. If 'Err007' is repeated, return unit to the manufacturer.
"Err008"	Illegal PIN entry	Incorrect PIN entered.
"Err009"	Access denied	Three consecutive incorrect PIN entries made.
"Wrn010"	Wait! Zeroing	Zero in progress. Set-point, rate and controller ON/OFF commands will not be executed until after zero action is completed.

Error Codes (contd)

Code	Error	Remedy
"Err011"	Set-point value 120% of range.	Reduce Set-point value or change range.
"Err012"	Remote enable	Do not enter data by the front panel or Enable front panel for manual control.
"Err013"	Invalid entry	Value entered is outside limits or illegal.

4 Fault Finding

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
No display, No LED on front panel illuminated.	Power supply failure:	
	No power supply to the instrument.	Check power supply source, fuse etc.
	Power supply cable assembly faulty.	Replace power supply cable assembly.
	Power supply fuse blown.	Replace fuse in the power supply inlet module ensure the correct type and rating fitted. Check voltage selector setting correct for supply voltage.
	Power supply inlet module faulty.	Replace power supply inlet module or cable assembly.
	PSU (switch mode) fault.	Using suitable voltmeter on DC range, check supplies to the Main PCB at PL9 test points: +5V, +/-15V, +24V, -5V, PFAIL.

NOTE: R8 minimum load resistor required by PSU to maintain regulation.

		Check PSU to Main PCB (SK9) cable assembly.
		Check PSU internal fuse. Replace internal fuse ensure the correct type and rating fitted and test PSU.
		Replace PSU if faulty.
	Front panel/ Main PCB interconnection fault.	Check PL1-SK8 cable assembly. Check PL2-SK14 cable assembly.

FRONT PANEL ASSEMBLY

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
No displays.	Front panel - main PCB interconnection fault.	Check PL1-SK8 cable assembly.
	No supply to front panel assembly.	Check +5V supply, PFAIL at test points.
Displays frozen/ erratic/no response.	Hardware fault on display PCB or main PCB	Test the PCB and replace if faulty.
	No PFAIL signal.	Check PFAIL signal on TP - pin 6 IC6.
	No I/O serial data communication between front panel and main PCB.	Check serial input data on front panel PCB and output data on main PCB.
No 99999 display.	Display/driver faulty.	Test display PCB and replace if faulty.
No message display.	Interconnection fault.	Check +5V supply to module assembly. Check PL4-SK5 cable assembly.
	Dot-matrix display faulty.	Replace module assembly.

FRONT PANEL ASSEMBLY

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
No or some LED on front panel illuminated	Front panel/ main PCB interconnection faulty.	Check PL2-SK14 cable assembly.
	No LED drive signal or LED faulty.	Check each signal/LED in turn. OUT LED illuminated on power on. S and V LED illuminated with controller ON and set-point entered. LPP LED illuminated on Range 2 selection. A and R LED illuminated with External valve control enabled and controller ON and set-point entered. Replace Display PCB assembly or parts if faulty.
No Front panel key-press response.	Membrane Key-pad faulty.	Check SK3-PL3 connection. Replace key-pad if faulty.
	Hardware fault on display PCB assembly.	Check and replace display PCB assembly. if faulty.
	No I/O serial data communication between front panel and main PCB.	Check serial input data on front panel PCB and output data on main PCB.

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
Zero offset via key-press not possible i.e "Err007" repeated.	Zero error too large.	Refer to error codes for fault correction. Re-adjust internal coarse zero potentiometer for the relevant range, on the main PCB. Check calibration.
Cannot select desired RANGE signal.	Signal decoding fault.	Check signal multiplexer IC11 and IC14 on main PCB.
	Option fault.	Check to establish if problem due to faulty option PCB.
No response when RANGE 2 (LP) selected.	Low pressure protect valve fault (0-70 bar range only).	Vent system pressure to zero. Check drive signal to low pressure protect valve. Check and replace valve assembly if faulty.

CONTROLLER

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
No pressure on OUTLET port on Set-point demand and controller switched on.	No source pressure.	Ensure source pressure is 110% of selected range.
	Apply and release valve fault.	Check drive signal to Apply and Release valve.
		Check and replace valve assembly.if faulty.
	Isolation valve fault (0-70 bar range only).	Check drive signal to the isolation valve.
		Check and replace valve assembly if faulty.
	Zero isolation in operation over a long wait time.	Check wait time.

CONTROLLER

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
Unstable controlled pressure at OUTLET port.	Source pressure low or too high.	Ensure source pressure is 110% of selected range.
	Air leak on the outlet connection/system under test.	Check by switching the controller off. If the reading changes then pressure leak may be present.
	Port filters blocked.	Check sintered filters.
	Reference diffuser not fitted causing ambient pressure variation to affect reading. (Low pressure Gauge/Diff units only).	Fit reference diffuser into REFERENCE port. If necessary, replace sintered filter.
	Vent silencer blocked.	Replace sintered filter.
	Valves dirty.	Inspect and clean valve assembly.
	Incorrect controller SETUP parameters.	Re-enter controller SETUP parameters for optimum performance.

CONTROLLER

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
Unable to achieve controlled pressure on the OUTLET port.	Source pressure low or too high.	Ensure source pressure is 110% of selected range.
	Transducer damaged.	Check for Diaphragm damage. On Gauge transducers, check for pressure leak at REFERENCE Port connection. Replace transducer with the correct type, range etc. Re-calibrate for temperature drift, Linearity etc.

TRANSDUCER

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
Range 1 (HP) transducer damaged.	Pressure overload.	Replace transducer with the correct type, range etc. Re-calibrate for temperature drift, Linearity etc.
	Source pressure exceeded instrument pressure range causing Apply valve to lift off the seat. (0-10 bar range only).	Source pressure should be 110% of the range selected!
	Apply valve permanently energized/ faulty.	Check drive signal to Apply valve.
		Check for valve seat damage. Replace Valve assembly if faulty.
Range 2 (LP) transducer damaged.	Pressure overload.	Replace transducer with the correct type, range etc. Re-calibrate for temperature drift, Linearity etc.
	Source pressure exceeded instrument pressure range causing Apply and LPP valve to lift off the seat. (0-10 bar range only).	Source pressure should be 110% of the range selected!
	Low pressure protect valve permanently energized/faulty (0-70 bar range only).	Check drive signal to Low pressure protect valve.
		Check for valve seat damage. Replace valve assembly if faulty.

FUNCTIONAL PROBLEMS

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
No external valve control signal response.	Function disabled.	Refer to handbook.
	No I/O connection.	Check I/O connection.
	No Drive signals.	Check drive circuit on Main PCB assembly.
No response when Cal enabled switch on the rear panel set to ENABLE.	Cal enable switch faulty.	Replace switch.
	Cal enable cable assembly fault.	Check SK5 to PL5 main PCB cable assembly.

PRINT INSTRUCTIONS K102 Issue 1

Document:

K102 on one WordPerfect file.

Associated Drawings:

Figure 1	Drawing No:	E-A3-1047 front panel
Figure 2	Drawing No:	FlowChart file - loop control
Figure 3 (Circuit Diagram)	Drawing No:	C-A1-0383 (3 of 4) transducer and control signal

Referenced Documents:

J100	Front Panel Assembly, test specification
J101	Main PCB Assembly, test specification
J102	Final Assembly, test specification
J118	IEEE 488 Option, test specification
J127	Analogue output Option, test specification
J133	SCM Option, test specification
TS145	RS232 Option, test specification
TS151	Barometric Option, test specification
TSTBA	Aeronautical Option, test specification

Reduce drawings and paste in as appropriate.

Circuit diagram (figure 3) to be reduced to A3 size and folded.

Print this document in Black on White, A4 sized paper.

Further Documents:

TN048	Front Panel circuit, technical description.
TN049	Main PCB circuit, technical description.

Further Circuit Diagrams:

C-A1-0383 (1 of 4)
C-A1-0383 (2 of 4)
C-A1-0383 (4 of 4)
C-A1-0387 (1 of 1)
C-A1-0436 (1 of 1)

These further documents and circuit diagrams should be made available if requested.

ACCURACY

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
Inaccurate readings (Controller On).	Transducer/instrument requires calibration.	Re-calibrate instrument.
	Incorrect controller SET-UP parameters.	Re-enter Controller SET-UP parameters for optimum performance.
Inaccurate readings (Controller Off).	Factory set nominal full-scale reading i.e. 2.5V or equivalent shifted.	Re-adjust Internal Span potentiometer on the main PCB and re-check for accuracy.
	Incorrect Linearity calibration.	Re-linearize.
	Transducer diaphragm damaged.	Check for linearity, hysteresis and repeatability. Replace transducer if faulty and re-calibrate.
	Temperature drift.	Check internal temperature sensor. Re-compensate and re-linearize.

FAULT FINDING OPTIONS

IEEE 488 OPTION

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
Error message /code displayed.	User.	Refer to error codes and remedy as necessary.
No/unusual Response.	No I/O connection.	Check I/O connection.
	User control program.	Refer to Handbook. Check control program.
	Option PCB faulty.	Check and replace option PCB assembly.

RS232 OPTION

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
Error message /code displayed.	User.	Refer to error codes and remedy as necessary.
No/unusual Response.	No I/O connection.	Check I/O connection.
	User control program.	Refer to Handbook. Check control program.
	Option PCB faulty.	Check and replace option PCB assembly.

SCM OPTION

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
Error message /code displayed.	User.	Refer to error codes, remedy as necessary.
No/unusual response.	No I/O connection.	Check I/O connection. Check SCM signal box.
	Incorrect user operation.	Refer to Handbook.
	Option PCB faulty.	Check and Replace option PCB assembly.

ANALOGUE(0-10V) OUTPUT OPTION

SYMPTOM	POSSIBLE CAUSE	CHECK/ACTION
No/unusual response.	No I/O connection.	Check I/O connection.
	User.	Refer to Handbook.
	Option PCB faulty.	Check and replace option PCB assembly.

PART 4

PARTS LIST

PARTS LIST

1 GENERAL

1.1 The purpose of the list is to itemise the parts that can be replaced without the return of the unit to **DRUCK**. It is intended for use in the provisioning and requisitioning of replacement parts.

2 USING THE PARTS LIST

2.1 The parts list show items with reference to the index number. The index numbers show the order of dismantling.

2.2 Parts are indented to show their relationship to the next higher assembly. The quantity shown for each item is the quantity required for the next highest assembly.

2.3 Items identified with the symbol * after the part number indicate a recommended stock-held item.

ITEM NO	PART NO	DESCRIPTION	QTY
1	IA0-TBA	CONTROLLER/CALIBRATOR DPI 510	1
2	163-001	.CABLE ASSEMBLY, POWER SUPPLY	1
3	IA0808-1C	.INLET MODULE, POWER SUPPLY, AND CABLE ASSEMBLY	1
4	853-026	.COVER, TOP	1
5	853-027	.COVER, BASE	1
6	195-025	.FEET	4
7	195-075	.FUSE, 2A, 20mm, HRC, ANTI-SURGE	1
8	191-063	.POWER SUPPLY UNIT	1
9	195-XXX	..FUSE, 3A, 20mm, HRC, ANTI-SURGE	1
10	159-023	.CRIMP TERMINAL [230/115V PSU JUMPER]	2
11	176-025	.MANIFOLD ASSEMBLY, 2 BAR, (ABSOLUTE UNITS)	1
12	184-061	..VALVE SUB-ASSEMBLY, APPLY AND RELEASE	2
13	184-062	..VALVE SUB-ASSEMBLY, ISOLATION	1
14	195-077	..FILTER, SINTERED	4
15	176-026	.MANIFOLD ASSEMBLY, 10 BAR (ABSOLUTE, GAUGE AND DIFFERENTIAL)	1
16	184-061	..VALVE SUB-ASSEMBLY, APPLY AND RELEASE	2
17	184-062	..VALVE SUB-ASSEMBLY, ISOLATION	1

ITEM NO	PART NO	DESCRIPTION	QTY
18	184-062	..VALVE SUB-ASSEMBLY, PROTECTION, LOW PRESSURE	1
19	195-077	..FILTER, SINTERED	4
20	176-027	.MANIFOLD ASSEMBLY, 10 TO 70 BAR (ABSOLUTE, GAUGE AND DIFFERENTIAL)	1
21	184-062	..VALVE SUB-ASSEMBLY, APPLY AND RELEASE	2
22	184-062	..VALVE SUB-ASSEMBLY, ISOLATION	1
23	184-062	..VALVE SUB-ASSEMBLY, PROTECTION, LOW PRESSURE	1
24	195-077	..FILTER, SINTERED	4
25	176-028	.MANIFOLD ASSEMBLY, 0 TO 210 BAR (ABSOLUTE, GAUGE AND DIFFERENTIAL)	1
26	195-078	..FILTER, SINTERED	4
27	204-024	.WASHER, BONDED (DOWTY 400-020-4490-41)	4
28	IA0906-1-V0	.SILENCER (VENT PORT)	1
29	195-079	.FILTER, SINTERED (VENT ASSEMBLY)	1
30	IA0906-1-V0	.SILENCER (REFERENCE PORT DIFFUSER, >2 BAR ABS OR >1 BAR GAUGE UNITS ONLY)	1
31	IA0796-1-V0	.DISPLAY ASSEMBLY	1
32	063-027	..EPROM 27C64, (CMOS), PROGRAM TO DK76 [IC3 ON DISPLAY PCB]	1
33	193-040	.MODULE 2*20, VFD, (DOT-MATRIX)	1
34	200-035	.KEY-PAD, MEMBRANE	1
35	063-024	..EPROM 27C256, (CMOS), PROGRAM TO DK80 [IC2 ON MAIN PCB]	1

ITEM NO	PART NO	DESCRIPTION	QTY
36	158-018	.CONNECTOR, 6 POLE, PLUG FREE, GREENPAR [REMOTE TRANSDUCERS]	1
37	159-021	.CONNECTOR, 6 POLE, SOCKET FREE [EXTERNAL ROUGHING SIGNALS]	1
38	IA0864-1-V0	PCB ASSEMBLY, IEEE 488 OPTION	1
39	063-027	.EPROM 27C64 (CMOS) PROGRAM TO DK86 [IC2 ON IEEE 488 OPTION PCB]	1
40	160-008	CONNECTOR, D-TYPE 25-WAY, PLUG	1
41	145-003	COVER, D-TYPE 25-WAY	1
42	IA0865-1-V0	PCB ASSEMBLY, RS232 OPTION	1
43	063-027	.EPROM 27C64 (CMOS) PROGRAM TO DK88 [IC2 ON RS232 OPTION PCB]	1
44	160-008	CONNECTOR, D-TYPE 25-WAY, PLUG	1
45	145-003	COVER, D-TYPE 25-WAY	1
46	IA0866-1-V0	PCB ASSEMBLY, SCM OPTION	1
47	060-038	.EPROM 28C64 (CMOS) PROGRAM TO DK85 [IC12 ON SCM OPTION PCB]	1
48	IA0908-1-V0	BOX, SIGNAL EXTENSION [SCM OPTION]	1
49	IA0867-1-V0	PCB ASSEMBLY, ANALOGUE OUTPUT OPTION	1
50	154-003	.CONNECTOR, D-TYPE 9-WAY, PLUG	1
51	145-003	.COVER, D-TYPE 9-WAY	1