QA-1290

User & Service Manual

1.66 Firmware and higher.
QA-1290 NIBP-Analyzer

METRON

P/N 17525

V.1.66

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METRON warrants that the QA-1290 NIBP Analyzer will substantially conform to published specifications and to the documentation, provided that it is used for the purpose for which it was designed. METRON will, for a period of twelve (12) months from date of purchase, replace or repair any defective analyzer, if the fault is due to a manufacturing defect. In no event will METRON or its local representatives be liable for direct, indirect, special, incidental, or consequential damages arising out of the use of or inability to use the QA-1290 NIBP Analyzer, even if advised of the possibility of such damages. METRON or its local representatives are not responsible for any costs, loss of profits, loss of data, or claims by third parties due to use of, or inability to use the QA-1290 NIBP Analyzer. Neither METRON nor its local representatives will accept, nor be bound by any other form of guarantee concerning the QA-1290 NIBP Analyzer other than this guarantee. Some jurisdictions do not allow disclaimers of expressed or implied warranties in certain transactions; therefore, this statement may not apply to you.

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Manual Revision Record

This record page is for recording revisions to your *QA-1290 NIBP Analyzer User & Service Manual* that have been published by METRON AS or its authorized representatives. We recommend that only the management or facility representative authorized to process changes and revisions to publications:

- make the pen changes or insert the revised pages;
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Rev No	Date Entered	Reason	Signature of Person Entering Change
1	1-15-2001	New Features added in V1.57 firmware	
2	4-27-2001	General update & Schematics added	
3	1-14-2003	Update to correspond with 1.66 Firmware	

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1. Introduction

This chapter describes the METRON QA-1290 Non-Invasive Blood Pressure (NIBP) Analyzer's features and specifications.

1.1 Features

METRON's QA-1290 NIBP Analyzer is a precision instrument, designed for use by trained service technicians, for verifying the performance of all types of adult and neonate oscillometric NIBP monitors.

It does this in two stages. The first stage is auto-calibration. QA-1290 calibrates both the cuff and tubing in order to verify the NIBP monitor used. Then, the QA-1290 performs calibrated simulations under all conditions.

The QA-1290 provides for dynamic performance testing using both real and simulated blood pressure waveforms. Blood pressure waveforms include individual settings for systolic BP, diastolic BP, heart rate, and the pulse volume/amplitude.

The QA-1290 also simulates calibrated artifact and arrhythmias in a large variety of real-life conditions. It provides high/low pressure release verification and automated leak testing. It also generates user selectable pressure levels to calibrate a variety of pressure monitors.

Highlights:

- High performance, compact design, simple to use
- Performs a complete test including cuff and tubing
- Large selection of adult and infant preset BP conditions
- Programmable customized patient conditions
- Simulation of real-life artifact and arrhythmia conditions such as: Bradycardia, Tachycardia, Geriatric Patient, Obese Patient, Strenuous and Mild Exercise, Weak Pulse, Premature Atrial Contraction, Premature Ventricular Contraction, 2nd Degree Heart Block, Atrial Fibrillation.
- Digital manometer with automatic or manual inflation of the cuff pressure for Leak Test and Over Pressure Cut-off Test
- Updates and enhancements of internal firmware via the RS-232

Test results, shown in the QA-1290's digital display, can be printed out directly, or transferred to a PC via the ***ansur*** QA-1290 test automation software. ***ansur*** lets you design test protocols, remotely control the QA-1290, and store the test results.

1.2 Specifications

1. Simulations

Simulation technique:	Oscillometric
Calibration Tables used:	DINAMAP, HP-Merlin
Simulation repeatability:	±0.5 mmHg
Heart Rate:	10-200 bpm, 1 bpm steps
Heart Rate Accuracy:	±1 bpm @pp≤ 2 mmHg
Pulse Pressure:	0.05-5.00 mmHg
Systolic/Diastolic Pressure:	As shown below

Preset Pressures
(Systolic/Diastolic (MAP), in mmHg)

Adult		Neonate	
60/ 30	(40)	60/ 30	(40)
80/48	(58)	80/48	(58)
100/65	(77)	100/65	(77)
120/80	(95)	120/80	(95)
150/95	(114)	150/95	(114)
200/140	(167)	200/140	(167)
255/195	(215)	255/190	(220)

Independent Systolic/Diastolic Settings
(in mmHg)

Systolic	20 to 255
Diastolic	5 to 220
Pulse Pressure	0.05 to 5.00

Preset Artifacts and Arrhythmias

Artifacts include: Bradycardia, Tachycardia, Geriatric, Obese, Strenuous Exercise, Mild Exercise, and Weak Pulse

Arrhythmias include: Premature Atrial Contraction, Premature Ventricular Contraction, Atrial Fibrillation, and 2nd Degree Heart Block

Custom Patient Pattern Mode

An arbitrary patient pattern can be downloaded via RS-232 and ***ansur*** software.

Motion/Tremor Artifact:

Available at all BP Start screens

2. **Pressure / Leakage Measurements**

Pressure Range\Accuracy:	0 to 500 mmHg automatic or manual inflation
	Accuracy +/- 1mmHg
	Units of measure mmHg, cmH20, inH2O, PSI, kPa, mBar.
Digital Readouts:	Manometer, Start Pressure, Peak Pressure, Pressure Drop, Deflation Time and Leak Rate.
Leak Rate Range:	1 to 500 mmHg/minute
Total Leak Measurement Time:	60 seconds (and each subsequent 60 seconds)

1.3 General Information

Display/Control:	Type: LCD Alphanumeric format: 4 lines, 40 characters Display control: 7 F-keys and keypad
Data Input/Outputs (2):	Parallel printer-port (1): Bi-directional 25-pin, Type Centronics, RS-232C: (1) for Remote Control
Power:	From 110 VAC to 240 VAC, 47/63 Hz
Housing:	Aluminum
Weight (w/o batt.):	5.5 kg / 12.1 lb.
Dimensions:	Height: 9.5 cm / 4 in. Width: 30.0 cm / 11.7 in. Length: 27.0 cm / 11 in.
Temperature Requirements:	+15 °C - 35 °C / +59 °F - +95 °F while operating 0°C - +50°C / +32°F - 122 °F for storage
Part No:	QA-1290 NIBP Analyzer (P.N. 17500)
Standard Accessories:	*QA-1290 User & Service Manual* (P.N. 17525
	BP Cuff Mandrels: Medium Adult (95 mm 0D, 178 mm width) and Neonate (27 mm 0D, 43 mm width)
	QA-1290 Tubing Kit (P.N. 17515) Cuff Adaptors:[1] DINAMAP, Luer, Luer-Lock, HP-Merlin, Propaq/Marquette, IVAC (1/4" hose/barb), Baum (5/32" hose/barb), 1/8" hose/barb
Optional Accessories:	QA-1290 Carrying Case (P.N. 17510)
	Ansur plug in for QA-1290 (P.N.

[1] Specifications may be subject to change without notice.

[1] Note: Adapters connect to the QA-1290 Pressure Ports via quick-disconnect, airtight, O-ring pressure fittings.

17520)

User\Manual QA-1290 (P.N. 17525)

Tubing Kit (P.N. 17515)

2. Installation

This chapter explains unpacking, receipt inspection, and setup.

2.1 Receipt, Inspection and Return

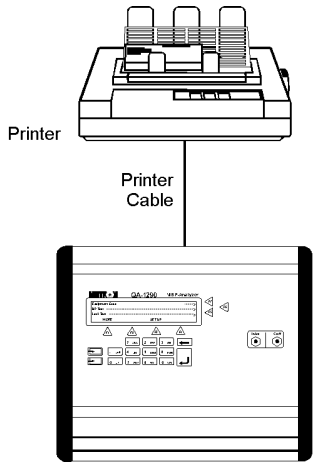
1. Inspect the outer box for damage.
2. Carefully unpack all items from the box and check to see that you have the following items:
   - QA-1290 NIBP Analyzer (P.N. 17500)
   - QA-1290 Tubing Kit (P.N. 17515)
   - BP Cuff Mandrels – adult and neonate
   - *QA-1290 User & Service Manual* (P.N. 17525)
3. If you note physical damage, or if the unit fails to function according to specification, inform the supplier immediately. When METRON or the company's Sales Agent is informed, measures will be taken to either repair the unit or dispatch a replacement. The customer will not have to wait for a claim to be investigated by the Sales Agent. The customer should place a new purchase order to ensure delivery.
4. When returning an instrument to METRON, or the Sales Agent, fill out the address label, describe what is wrong with the instrument, and provide the model and serial number. If possible, use the original packaging material for return shipping. Otherwise, repack the unit using:
   - a reinforced cardboard box, strong enough to carry the weight of the unit.
   - at least 5 cm of shock-absorbing material around the unit.
   - nonabrasive dust-free material for the other parts.

   Repack the unit in a manner to ensure that it cannot shift in the box during shipment.

   METRON's product warranty is on page ii of this manual. The warranty does not cover freight charges. C.O.D. will not be accepted without authorization from METRON or its Sales Agent.

2.2 Setup

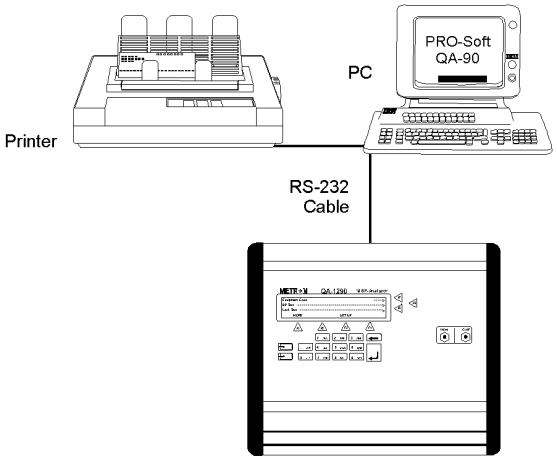
Equipment connection is as shown in the typical setup below. Attach the printer cable to the 25-pin outlet port.



If ***ansur*** QA-1290 is being used, attach an RS-232C (null modem/data transfer configured) cable to the 9-pin D-sub outlet port located at the rear of the QA-1290. Do not attach the printer cable to the QA-1290. *See belo*w.

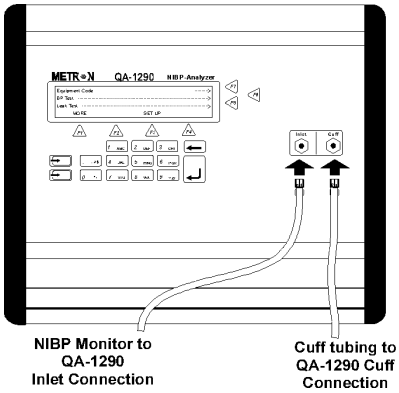
NOTE

Some RS-232C cables are missing the connection between the seventh and the eighth wires in the cable. The cable may still be called NULL-modem, but it will not work with the QA-1290. Refer to the ***ansur*** QA-1290 Users Manual for more information.

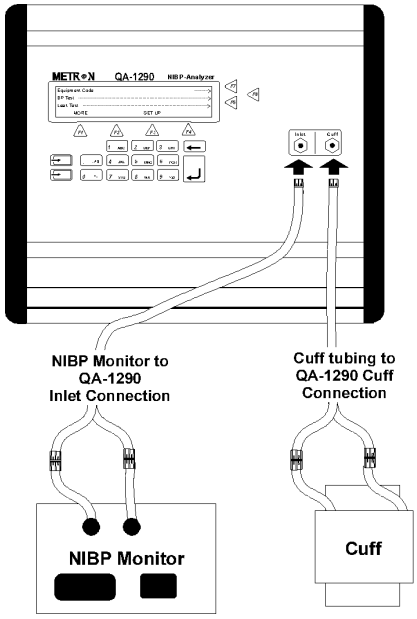


2.3 Connecting the Device under Test

The connection of a mono-tube NIBP Analyzer and cuff is as shown below. Tubing from the NIBP Analyzer is connected to the luer lock on the Inlet Port, while the Cuff's tubing is connected to the luer lock on the Cuff Port.



The connection of a NIBP Analyzer and cuff that use two tubes is as shown below. Tubing from the NIBP Analyzer is connected to the luer lock on the Inlet Port, while the Cuff's tubing is connected to the luer lock on the Cuff Port.



With its Tubing Kit (P.N. 17515) METRON offers a number of pressure connector adapters. The adapters connect to the QA-1290 Pressure Port via a quick-disconnect, airtight, O-ring pressure fitting. *See Appendix A, Tubing Kit Components.*

Note: *The QA-1290 has an internal fixed volume that is used to simulate the cuff once the simulation begins . By connecting the inlet port and cuff port of the QA-1290 together and then to the monitor under test testing can be done without an external cuff connected.*

2.4 Ansur plug in QA-1290

Ansur for the QA-1290 is a front-end test automation and presentation tool for METRON's QA-1290 NIBP Analyzer. It allows you to conduct the same tests, but by remote control via an IBM-compatible PC/XT with MS Windows (Version 98 or later). Additionally, the program has additional features to automate and enhance your testing program.

Each of the QA-1290 tests can be run independently from Ansur. Results are shown on the PC screen during testing, and the user is prompted to set the tested equipment accordingly. At the conclusion of tests, the user may print a report, store the test and results on disk, or both. Combinations of tests can be created and stored as "Test Templates." The program maintains a library of these sequences. In this way you can store and retrieve sequences that are appropriate for each kind of equipment being tested at your facility.

NOTE

Ansur QA-1290 has its own user manual which contains all the information concerning the program. If you order a demonstration version of the program you also receive the manual.

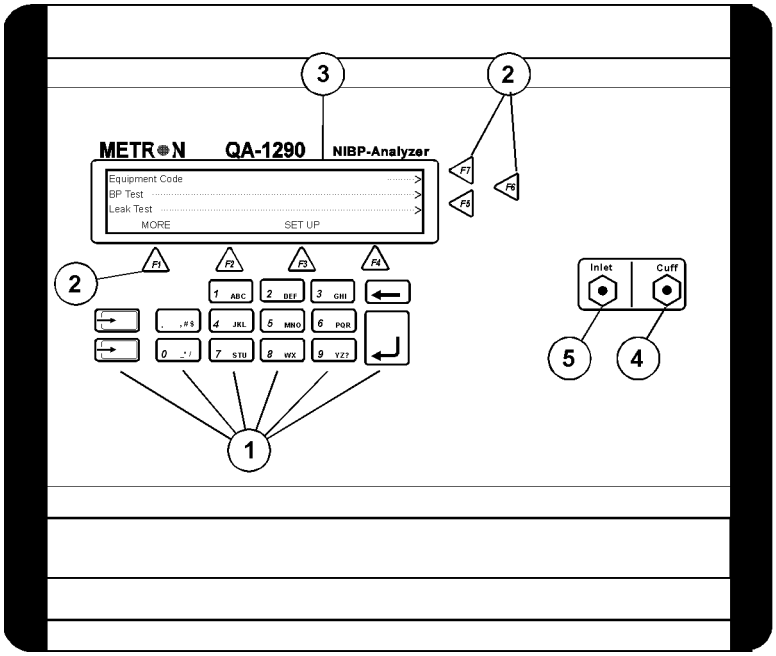
Sequences can then be used independently, or can be attached to a checklist, written procedure, and equipment data in the form of a test "Protocol." The equipment data can be entered manually into the protocol, or it may be retrieved by Ansur from equipment database management programs, such as METRON's QA-MAP, WOSYST or other equipment files. Protocols can be created easily for each item of equipment in your inventory, and stored for use. Test protocols with results can be printed, or stored on disk, and the results of testing can be sent back to the equipment database to close a work order and update the service history.

3. Operating QA-1290

This chapter explains the operating controls, switches and menus of the QA-1290, details how to use them in testing, and provides general information on printouts.

3.1 Control Switches and Connections

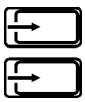
Front Panel



1. Key Pad — 11 alphanumeric keys, used to enter information.

Delete: Prior to saving, deletes the last character entered. After saving, deletes the entire entry in the data field.

Enter: Saves data in field that was entered by keying with the alphanumeric keys.



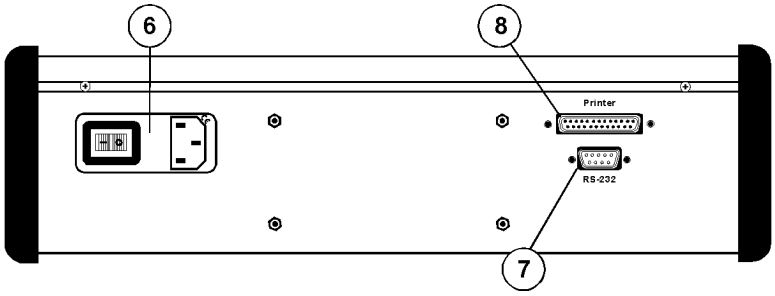
Only used for firmware upgrades.
See paragraph 3.8 below.

2. Function Keys — F1-F4 are used to select the functions shown in the menu bar at the bottom of the display, i.e., for selecting the function that is directly above the key. F5-F7 are used to select a function, or enter information in

the message field in the same line.

3	**LCD Display**	Shows messages, test results and function menus.
4	**Cuff Port**	
5.	**Inlet Port**	

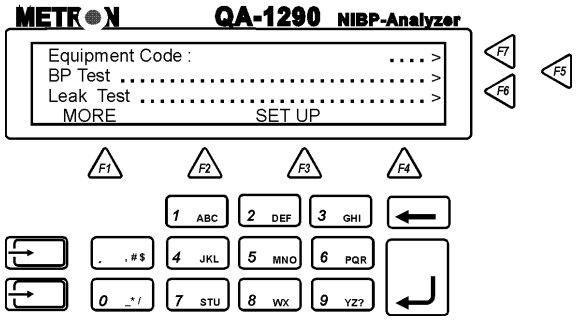
Rear Panel



6.	**Power Switch and Mains**	Power switch turns power ON and OFF. Mains connects the QA-1290 to the 110 VAC - 240 VAC, 47/63 Hz power source.
7.	**RS-232 Port**	9-pin D-sub for Remote Control.
8.	**Printer Port**	Bi-directional 25 pin D-sub. Centronic output.

3.2 QA-1290's Controls

QA-1290's display, alphanumeric data entry keys, control keys and programmable function keys provide flexibility and control in testing. Operating them is very similar to operating a personal computer.



There are four text lines to each screen. The top three lines are used for operator settings, system messages, and test status and results. They are controlled by the **F5**, **F6** and **F7** keys, located to the right of the display. Note, however, that these keys are active only when you see the leading arrows (". . . . .>") pointing to them. *(See above)*

The screen's bottom line is a menu bar, controlled by function keys **F1** through **F4** directly below the display. The menu is used for system functions, such as **PRINT** or **INFLATE**, and for inter-screen navigation, such as **MORE** and **GO BACK**.

Pressing and holding down one of the 11 alphanumeric keys causes it to move automatically from character to character. For example, pressing the “1 ABC” key and holding it down will scroll you automatically through “1”, then “A”, “B” and “C”. Release the key when the desired alphanumeric character appears.

3.3 QA-1290 Startup

When QA-1290 is switched **ON** the following screens are displayed in sequence. First, the system’s boot software and firmware versions are displayed. Then, QA-1290 performs a self-check and prompts you to zero the pressure before advancing to the Main Menu. *(See below)*

```
****************************************
**    M E T R O N                     **
**    Boot software ver  X.XX         **
****************************************
```

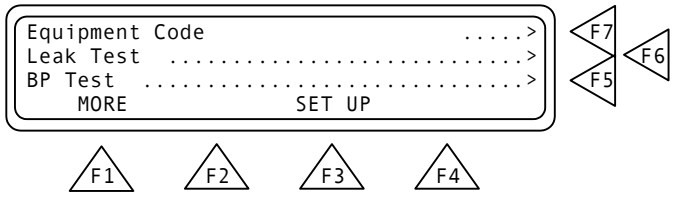
```
****************************************
**         METRON  QA-1290            **
** Version. X.XX Date. XX.XXXXXX XXXX **
****************************************
```

```
****************************************
**         METRON  QA-1290            **
** Self Check.  please wait.........  **
****************************************
```

```
****************************************
**         Pressure:  x  mmHg         **
**   Press any key to zero pressure   **
****************************************
```

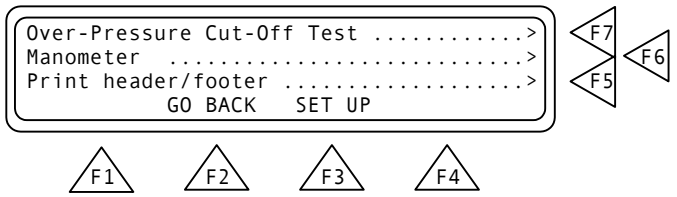
3.4 QA-1290 Main Menu

All QA-1290 operations start from the Main Menu, which consists of two screens. They control the type tests to be conducted, and enable you to configure QA-1290 settings and store them for use in testing.



Main Menu Screen 1 *(above)* contains the following settings:

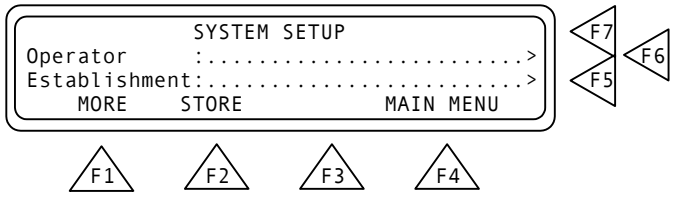
- Press **Equipment Code (F7)** to enter the facility code for equipment being tested. Then press **Enter** to save.
- Press **Leak Test (F6)** to advance to the Leak Test screen.
- Press **BP Test (F5)** to advance to the BP Test screens.
- Press **MORE (F1)** to advance to Main Menu Screen 2. *(See below).*



- Press **Over-Pressure Cut-Off Test/Manometer (F7)** to advance to that test's screen.
- Press **Manometer (F6)** to advance to that test's screen.
- Press **Print Header / footer (F6)** to advance to the Print Screen *(see paragraph 3.6 below).*
- Press **GO BACK (F2)** to return to Main Menu Screen 1, **SETUP (F3)** to advance to the Set Up Screen 1.

3.5 Configuring QA-1290

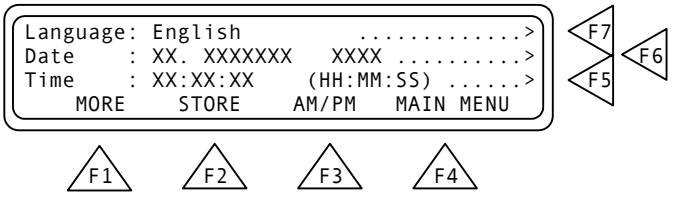
Pressing **SETUP (F3)** in either Main Menu Screen advances you to a series of screens that allow you to configure QA-1290 settings and store them for use in all testing. There are three Setup Screens.



Setup Screen 1. This screen *(above)* contains the following settings:

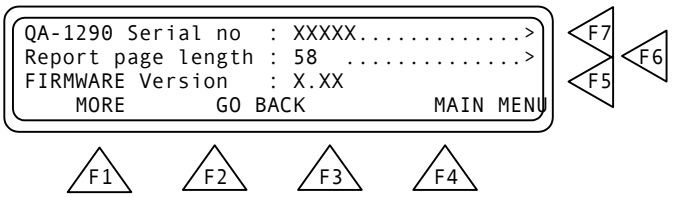
- Press **Operator (F6)**. Use the alphanumeric keys to enter the test operator's name or other identifying data. Press **Enter** to save.

- Press **Establishment (F5)**. Use the alphanumeric keys to enter the test facility's name or other identifying data. Press **Enter** to save.
- Press **MORE (F1)** to advance to Setup Screen 2.
- Press **STORE (F2)** to store all settings in QA-1290's flash memory.



Setup Screen 2. This screen *(above)* contains the following settings:

- **Language (F7)**. This is installed with METRON's Firmware version. No selection.
- Press **Date (F6).** Use the alphanumeric keys to set, or reset, the system date (DD/MM/YYYY). Press **Enter** to save.
- Press **Time (F5).** Use the alphanumeric keys to set, or reset, the system clock (HH:MM:SS). Press **F3** to specify the a 12-hour (**Am/Pm**) or 24-hour (**24 hour**) clock. Note: When **24 Hour** shows above **F3**, the system is operating on a 12-hour time schedule. When showing "**Am/Pm**" above **F3**, the system is operating on a 24-hour time schedule.
- Press **MORE (F1)** to advance to Setup Screen 3.
- Press **STORE (F2)** to store all settings in QA-1290's flash memory.



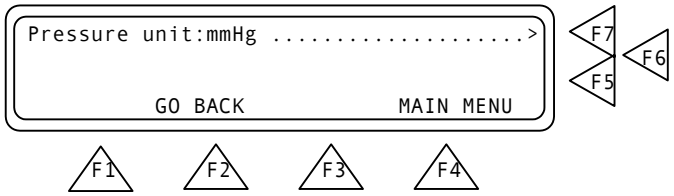
Setup Screen 3. This screen *(above)* contains the following settings:

- Press **QA-1290 Serial no. (F7)**. Use the alphanumeric keys to enter the QA-1290's serial number. Press **Enter** to save.
- Press **Report Page Length (F6).** Use the alphanumeric keys to set the length of the printed report.. The range is 10 to 999. Press **Enter** to save.

- This line shows the **FIRMWARE version** currently installed in the QA-1290. No selection.
- Press GO BACK (F2) to advance to Setup Screen 1.

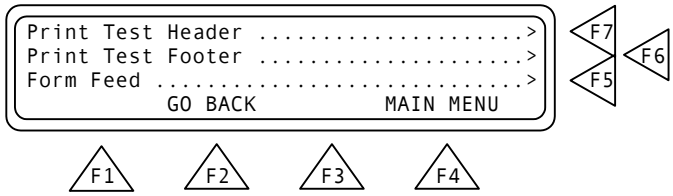
Setup Screen 4. Shown below allows the user to select different units of pressure measurement for Manometer,Leak and Overpressure testing only.

- **mmHg, cmH20, inH20, PSI, kPa, mBar**



3.6 Printing Results

A printed report may be prepared at the completion of testing. In each test results screen that shows the digital readout you can select **PRINT (F5)**. The Print Screen appears.

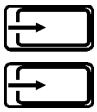


- **Print Test Header (F7)**. Selecting this prepares a Report Header for printing. The header contains identifying information relative to the facility and operator, the device under test, and QA-1290's setup configuration for the test.
- **Print Test Footer (F6)**. Selecting this prepares a Report Footer for printing. The footer is used for operator comments and signature.
- **Form Feed (F5).** Pressing this advances the page, currently being printed, in the printer.
- Press **GO BACK (F2)** to return to Test Screen.
- Press **MAIN MENU (F4)** to return to Main Menu Screen 1.

3.7 Upgrading QA-1290 Firmware

To install new firmware, use the following procedure. Note that the QA-1290 upgrade contains two files: **com[xxxx].exe,** which establishes communication between a PC computer and the QA-1290, and; [**xxxx].a07,** which is the actual QA-1290 upgrade file. **NOTE:** "**[xxxx]**" indicates the version of the firmware

1. Prepare the QA-1290 for the software upgrade.



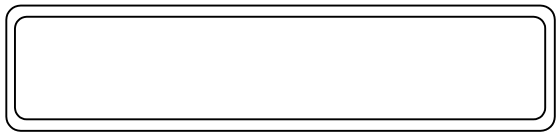
   - Press and hold the firmware upgrade keys on the keyboard *(see left)* **at the same time** while turning the QA-1290 **ON**.
   - The QA-1290 display will show the following:

```
The software in the QA-1290 is missing
To download new software, run COMM[XXXX]
on the PC and ENTER on the instrument
```

   - The QA-1290 is ready to receive the firmware upgrade.

2. Prepare the PC for the upgrade.
   - Connect an RS-232 cable between the PC and the QA-1290.
   - Insert the disk that contains the QA-1290 upgrade files.
   - Run **comm[xxxx].exe**, which is a DOS program.
   - The computer will then display a menu.
3. Perform the upgrade.
   - Choose menu 1 **SET PARAMETERS** and choose new parameters or default values.
   - Choose menu 2 **START COMMUNICATION** by pressing 2. Enter filename [**xxxx].a07** where XXXX is the version of the firmware.
   - Press **ENTER (↵)** on the PC.
   - Press **ENTER (↵)** on the QA-1290 and the transmission will start.

   If the communication is successful, **>>>>>>>** appears on all lines of the QA-1290's display during the file transfer *(see below).*



```
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
```

At the end of the transfer, a normal startup sequence will occur.

4. Test to confirm the upgrade.

   - Exit the DOS program and unhook the RS-232 transfer cable from the QA-1290.
   - Switch the QA-1290 **OFF**, then turn it back **ON**.

   Verify that the new firmware version is installed while the QA-1290 is running its start sequence. The firmware version will be displayed in Startup Screen Menu 3.

4. Blood Pressure Testing

This chapter describes step-by-step procedures for conducting QA-1290 blood pressure testing.

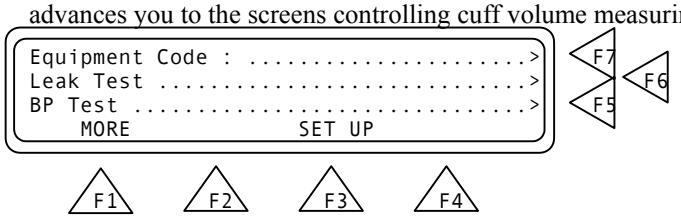
Blood pressure simulation is the most complex of the QA-1290's functions. It simulates a number of different patient conditions, each of which can be selected by the operator. These conditions include a large number of systolic, diastolic and heart rate values, as well as different types of irregular pulses.

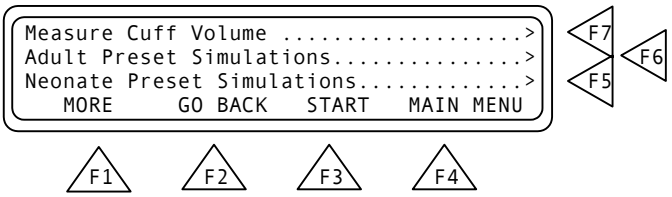
Three aspects of the QA-1290 should be noted:

1. Many different types of blood pressure monitors were used during QA-1290's development in order to ensure its compatibility with them. However, we have optimized QA-1290 for the widely used Criticon Dinamap Blood Pressure Monitor. Thus, measured values may differ somewhat from the selected values when testing monitors other than the Criticon Dinamap monitor. However, since QA-1290 is used for functional verification, and not calibration, these differences should not be of significant concern.
2. QA-1290 simulations are suitable only for oscillometric blood pressure measurements. In other words, it can be used only for testing monitors that measure the pulse pressure variations to find the systolic and diastolic values. QA-1290 is not intended for use in testing monitors that acoustically measure systolic and diastolic values.
3. During simulations the real cuff is disconnected, and an internal pressure chamber is used. This is for two reasons. One is that this makes it possible to optimize the QA-1290's pressure generator, because it then only needs to cope with a known volume (i.e., needed pulse volume for a given pulse varies with the cuff volume). The other reason is that the internal "cuff" is made of aluminum, which makes it rigid compared to real, rubber cuffs. This, in tern, makes it possible to obtain better control over pulse generation.

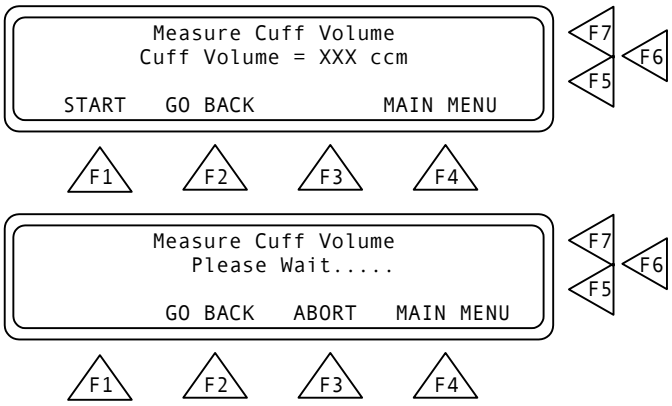
4.1 Measuring Cuff Volume

From Main Menu Screen 1 press **BP Test (F5)**. This advances you to the BP Test Index Screen. Press **Measure Cuff Volume (F7)**. This advances you to the screens controlling cuff volume measuring.





Press **START (F7)**. Pressurization of the cuff begins. The screen changes while measurement occurs *(see below)*, and a new menu item, **ABORT (F3)** is added, which can be used to stop pressurization.

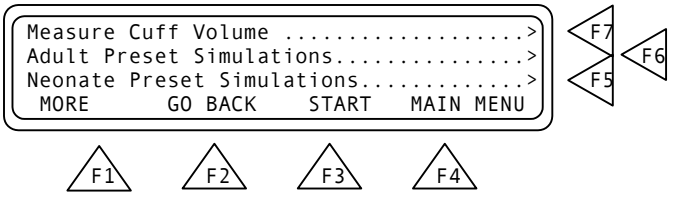


When the measurement is completed the cuff volume is displayed in cubic centimeters. Press **GO BACK (F2)** to return to the BP Test Index Screen.

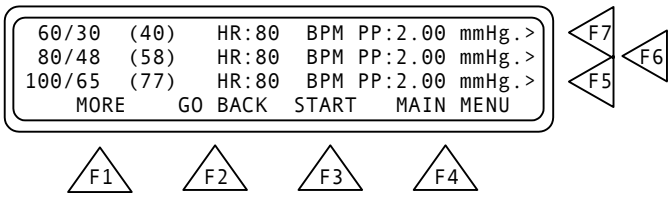
4.2 Setting Test Parameters

4.21 Preset Simulations (select BP Test from Main Menu)

QA-1290 simulates a variety of patient conditions through preset and programmable parameters. To select **Adult Preset blood pressures select (F6)** below and **(F5) for Neonate Preset Simulations.**



In either case you advance to a series of three screens in which you select the appropriate preset. The presets are diastolic/ systolic pressure, mean arterial pressure (MAP), heart rate (HR) and pulse pressure (PP). *(See the first screen in the sequence below).*



To select the desired preset use the **F5**, **F6** or **F7** key. The corresponding line will flash intermittently to indicate the selected preset. Below are the adult and neonate preset pressures.

Adult Preset Pressures

Diastolic//Systolic (mmHg)	MAP (mmHg)	Heart Rate (BPM)	Pulse Pressure (mmHg)
60 / 30	40	80	3.00
80 / 48	58	80	3.00
100 / 65	77	80	3.00
120 / 80	95	80	3.00
150 / 95	114	80	3.00
200 / 140	167	80	3.00
255 / 195	215	80	3.00

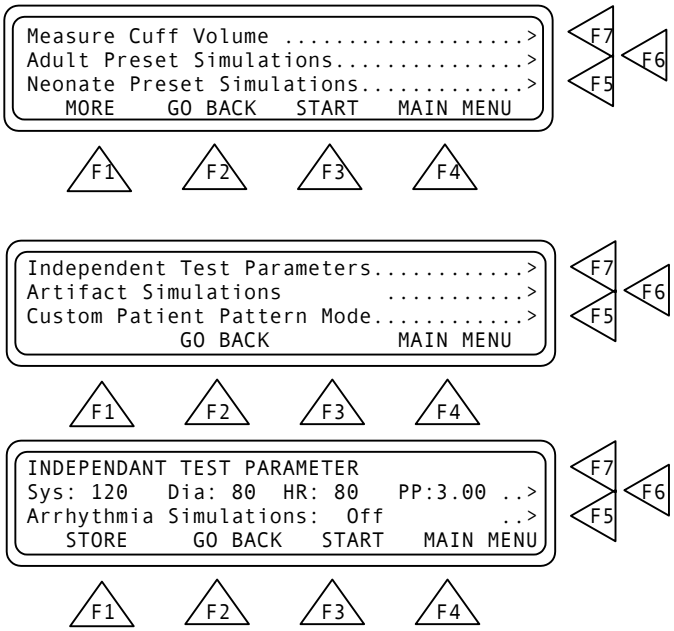
Neonate Preset Pressures

Diastolic//Systolic (mmHg)	MAP (mmHg)	Heart Rate (BPM)	Pulse Pressure (mmHg)
60 / 30	40	120	1.50
80 / 48	58	120	1.50
100 / 65	77	120	1.50
120 / 80	95	120	1.50
150 / 95	114	120	1.50
200 / 140	167	120	1.50
255 / 190	220	120	1.50

In the present pressure screen menu keys press:

- **MORE (F1)** to advance to the next preset screen.
- **GO BACK (F2)** to return to the Adult/Neonate Screen.
- **START (F3)** to advance to the BP Test Screen.
- **MAIN MENU (F4)** to return to Main Menu Screen 1.

4.22 Independent Test Parameters (F1). From the menu shown below(from BP Test at Main Menu) select more and then **(F7)** to set the desired blood pressure, heart rate or pulse amplitude and Arrhythmias.



Press the **F6** key to enter the desired pressure and heart rate settings. Once **F6** is pressed a cursor appears in the setting that is to be changed. Use the alphanumeric keys to enter the following setting(s):

- Systolic pressure (Sys) setting, between 20 and 255 mmHg.
- Diastolic pressure (Sys) setting, between 5 and 220 mmHg.
- Heart rate (HR) setting, between 10 and 200 BPM.
- Pulse pressure (PP) setting, between .05 and 5.00 mmHg.

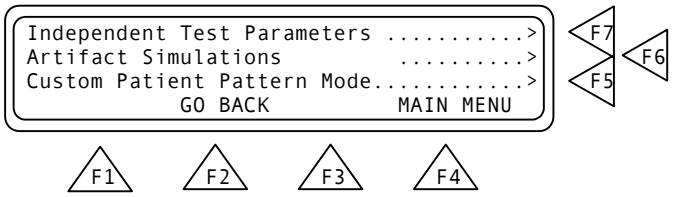
Press the **STORE F1** key to save the new setting(s).

Press the **F5** key to scroll through the arrhythmia simulations. Available selections, in sequence, are: Off, PAC, AFIB, 2-BLK II, PVC STD, and Artifact. When scrolling, each simulation flashes intermittently to indicate that it is not yet entered as a preset. Press the **Enter** key to set the desired simulation. Once set, the intermittent flashing stops.

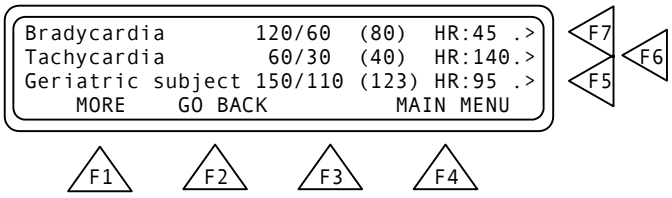
In the Independent Test Parameter Screen Menu press:

- **STORE (F1)** to store the settings in flash memory.
- **GO BACK (F2)** to return to the BP Test Parameters Index.
- **START (F3)** to advance to the BP Test Screen.
- **MAIN MENU (F4)** to return to Main Menu 1.

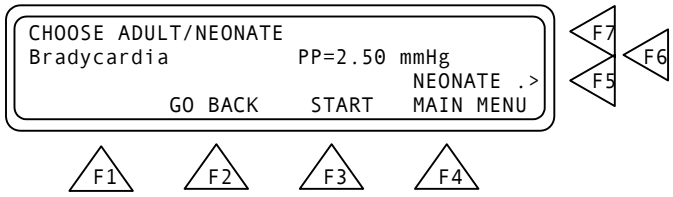
4.23 Artifact Simulations (F6). Pressing this advances you to a series of three screens, in which you select the desired artifact to use in the BP testing. To get to this Menu press BP TEST**(F5)** from the Main Menu and then more **(F1)**



Each of these Artifact Simulation Screens contains the simulated condition, along with the preset diastolic/systolic pressures, mean arterial pressure (MAP), and heart rate (HR). *(See the first screen in the sequence below).*



To select the desired preset use the **F5**, **F6** or **F7** key. When pressed you advance to another screen, indicating the condition's pulse pressure (PP). You also have the option at this point of selecting between adult or neonate settings for this condition. *(See the Bradycardia Artifact Screen in the sequence below).*



Below are the preset selections in the Artifact Simulation Screens.

Artifact Simulation Selections

Condition	Sys./Dia. (mmHg)	MAP (mmHg)	HR (BPM)	PP (mmHg) Adult	PP (mmHg) Neonate
Bradycardia	120 / 60	80	45	2.50	1.25
Tachycardia	60 / 30	40	80	0.80	0.40
Geriatric subject	150 / 110	123	95	1.00	0.50
Obese subject	120 / 80	93	90	1.00	0.50
Strenuous exercise	140 / 90	106	160	3.00	1.50
Mild exercise	140 / 90	106	120	2.50	1.25
Weak pulse	110 / 80	89	95	0.80	0.40

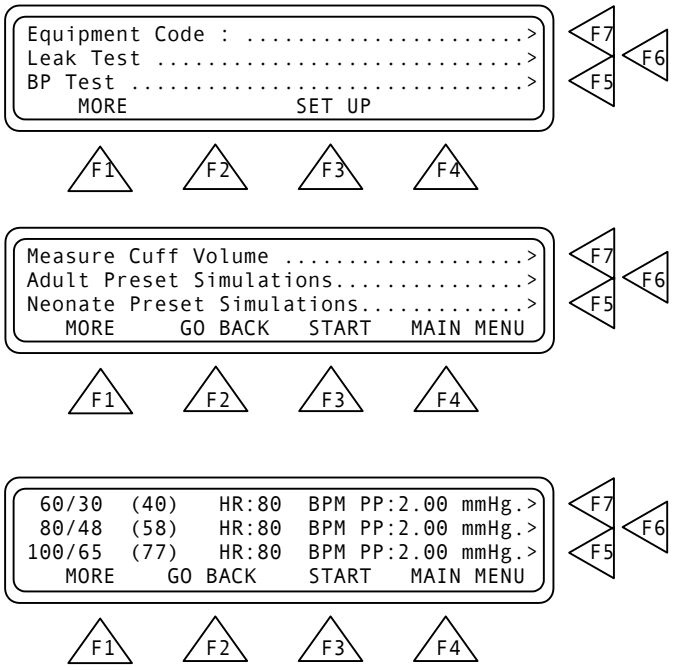
In the Artifact Simulations Screen Menus press:

- **MORE (F1)** to advance to the next simulation screen.
- **GO BACK (F2)** to return to the previous simulation screen.
- **START (F3)** to advance to the BP Test Screen.
- **MAIN MENU (F4)** to return to Main Menu Screen 1.
- **ADULT / NEONATE (F5)** to select adult or neonate settings for the condition displayed. Note: When **NEONATE** shows at **F5**, the current setting is "**Adult**". When showing **ADULT** at **F**5, the current setting is "**Neonate**".

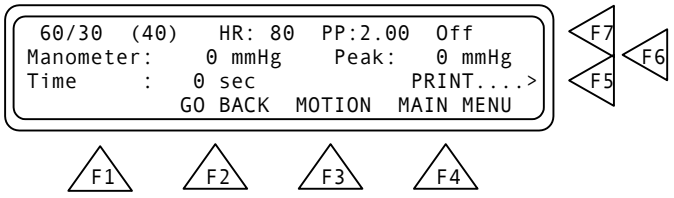
4.24 Custom Patient Pattern Mode (F5). This is the fourth **test** parameter, and is used for the downloading of arbitrary patient patterns via Ansur QA-1290 Plug-in software.

4.3 Running BP Tests

From Main Menu Screen 1 press **BP Test (F5)**. This advances you to the BP Test Index Screen. Press **Adult Preset Simulations(F6) and (F3)** to start the test.



The screen changes when the test is started *(see below).* The top line of the screen specifies the settings for the test, and includes the preset diastolic/systolic pressures, mean arterial pressure (MAP), heart rate (HR), pulse pressure (PP), and what arrhythmia simulation is used (if any).



The second and third lines display test readings for the manometer and peak pressure in millimeters of mercury (mmHg), and the inflation time in seconds.

In this test screen's menu press:

- **GO BACK (F2)** to return to the BP Test Index Screen.
- **MOTION (F3)** to initiate a motion/tremor artifact in the testing. This is to test exactly how a BP monitor responds to calibrated levels of motion and tremor.
- **MAIN MENU (F4)** to return to Main Menu Screen 1.
- **PRINT (F5)** if you want to print the test results. This advances you to the Print Screen.

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5. Leak, Manometer, and Over-Pressure Cut-off Testing

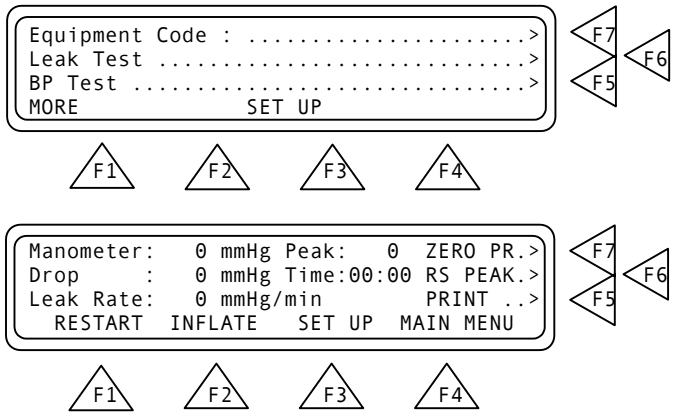
This chapter describes step-by-step procedures for conducting QA-1290 Leak and Over-Pressure Cut-off Tests.

The Leak Test is used to detect any leakage in the cuff, hose or connections within the monitor. For this test the QA-1290 pumps up a pressure and then measures the air leakage over time. There should be no leakage. However, if any exists, then it should be minimal (less than 1 mmHg per minute).

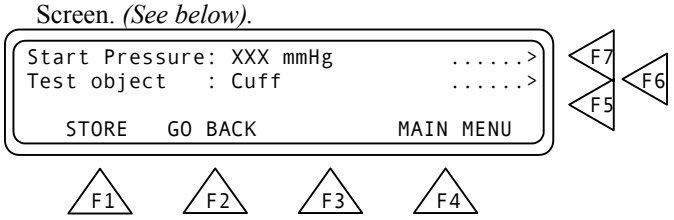
The Over Pressure Cut-off Test is used for testing the blood pressure monitor's security valve. Monitors have these valves to release pressure if it rises above a certain value, thus protecting the patient against too high a pressure in the event of a monitor malfunction. QA-1290 increases the pressure to a predefined value. If the value exceeds the monitor's release pressure, the monitor will release. QA-1290 will then indicate that the security valve is functioning correctly by indicating "OK". If the pressure is not released before the predefined pressure level is reached, QA-1290 will display an error message.

5.1 Leak Test

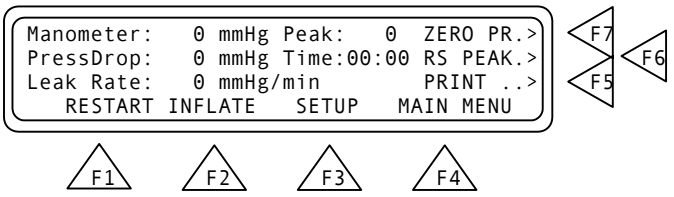
1. From Main Menu Screen 1 press **Leak Test (F6)**. This advances you to the Leak Test Screen..



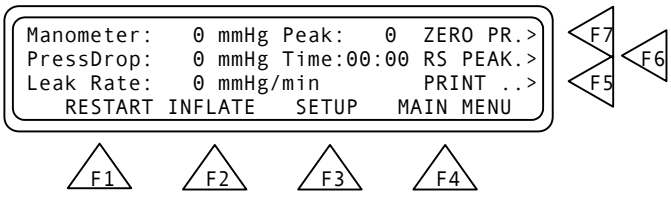
2. Press **SETUP (F3)**. This advances you to the Start Pressure Screen. *(See below).*



3. Use the alphanumeric keys to enter the **Start Pressure (F7)** setting to between 0 and 400 mmHg. Press the **Enter** key to save the new setting(s). Use the **Delete** key to clear the current setting.
4. Scroll through **Test Object (F6)** to enter the device under test. Available options are: Cuff, Monitor, and Cuff and Monitor.
5. Press:
   - **STORE (F1)** to store the settings in flash memory.
   - **GO BACK (F2)** to return to the Leak Test Screen.
   - **MAIN MENU (F4)** to return to Main Menu 1.



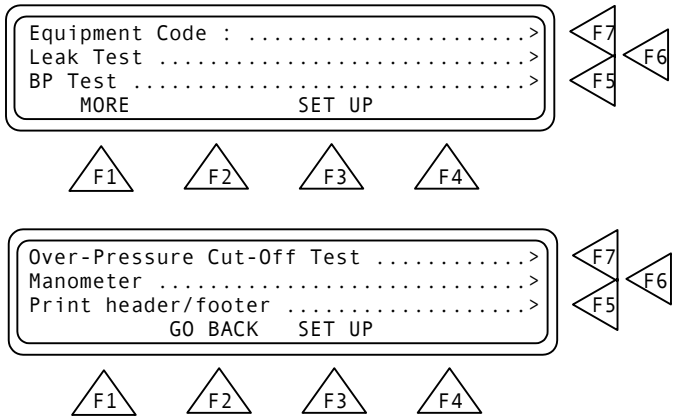
6. Press **INFLATE (F2)**. The menu changes and **DEFLATE (F2)** becomes active *(see below).* Wait until the inflation stops. When the test results are shown, press **DEFLATE**.
7. To reset the manometer and peak values to 0 mmHg, press **ZERO PR (F7)** and **RS PEAK (F6)**. Note that this also resets the time to zero.



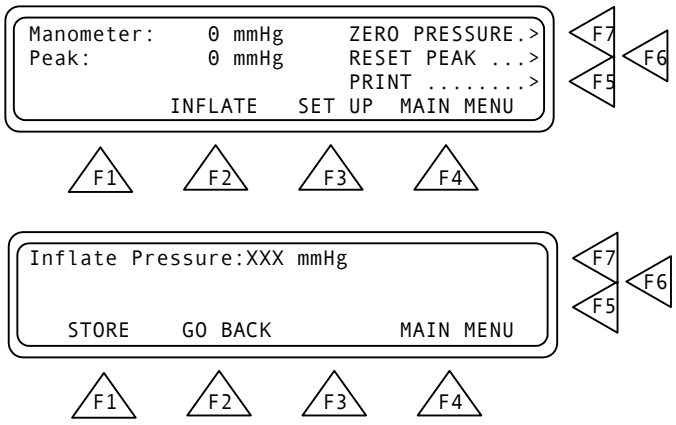
8. To repeat the test, press **RESTART (F1)**, which resets the results to zero. Then, press **INFLATE**.

5.2 Over-Pressure Cut-Off Test

1. Advance to Main Menu Screen 2. From this screen press **Over-Pressure Cut-Off Test (F7)**. This advances you to the test screen.



2. Press **SET UP (F3)**. This advances you to the Inflate Pressure Screen. *(See below).*

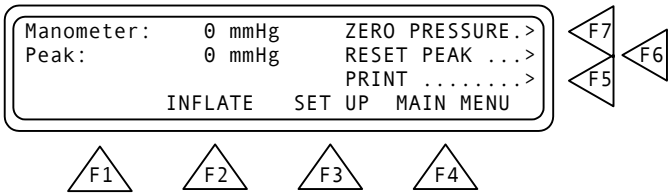


3. The **Inflate Pressure (F7)** value must be entered. Otherwise the test will fail. Use the alphanumeric keys to enter the pressure setting to between 0 and 500 mmHg. Press the **Enter** key to save the new setting(s). Use the **Delete** key to clear the current setting.

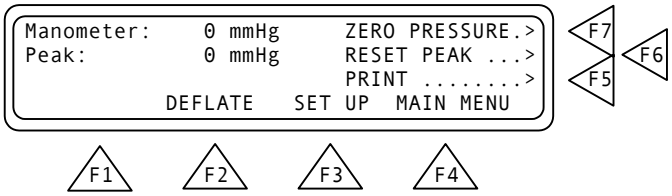
4. Press:

   - **STORE (F1)** to store the settings in flash memory.
   - **GO BACK (F2)** to return to the Over-Pressure Cut-Off Test Screen.

- **MAIN MENU (F4)** to return to Main Menu 1.



5. Press **INFLATE (F2)**. The menu changes and **DEFLATE (F2)** becomes active *(see below).* Wait until the inflation stops. When the test results are shown, press **DEFLATE**.

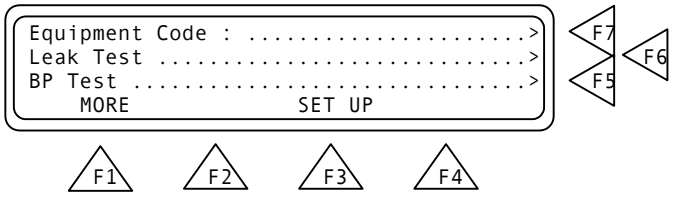


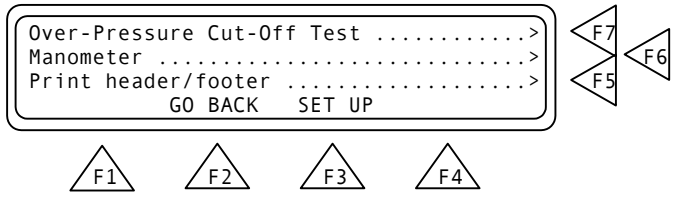
6. To reset the manometer and peak values to 0 mmHg, press **ZERO PRESSURE (F7)** and **RESET PEAK (F6)**. Note that this also resets the time to zero.
7. If you want to print the test results, press **PRINT (F5)** to advance to the Print Screen.

5.3 Manometer

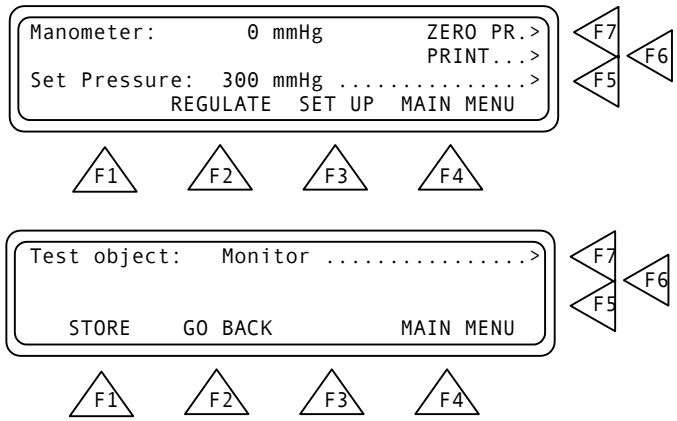
This test will let you select a pressure in mmHg and maintain it.

1. Advance to Main Menu Screen 2. From this screen press **Manometer (F6)**. This advances you to the test screen.

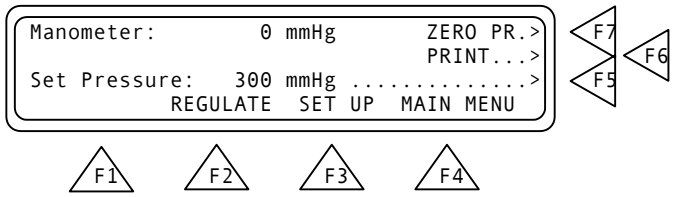




2. Press **SET UP (F3)**. This advances you to the Inflate Pressure Screen. *(See below).*



3. Press **Test object (F7)**. This allows you to select between **Monitor** and **Cuff and Monitor** as the port being used.
4. Press **STORE (F1)** to save the settings then press **GO BACK (F2)** to return to the manometer test.



5. To reset the manometer to 0 mmHg, press **ZERO PR (F7)**.
6. If you want to print the test results, press **PRINT (F6)** to advance to the Print Screen.
7. Press **Set Pressure (F5)** to key in the pressure that you wish the QA-1290 to maintain.
8. Once you have completed your setup press **REGULATE (F2)** to begin pressure regulation.

   Note: *It is possible to change the pressure units for the Leak, Manometer and OverPressure tests. From the Main Menu press (F3) setup and more (F1) 3 times until the menu item is displayed.*

   Pressure Unit: mmHg……> F7

   Press F7 for the desired pressure units. mmHg, cmH20, inH20, PSI, kPa, or mBar.

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6. Testing and Maintenance

This chapter covers QA-1290 testing, as well as maintenance and troubleshooting procedures.

6.1 Required Equipment

- Digital voltmeter, e.g. Fluke 87
- Pressure instrument, e.g. Drück DPI-601

6.2 Testing Procedures

1. Power Supply
   - Connect +5.0 v and +24.0 v on P300.
   - Measure the following voltages are referenced to ground on T307.

Reference	Nominal value
T300 - T307	+24.0 V ± 7%
T306 - T307	+5.0 V ± 5%
T301 - T307	+15.0 V ± 5%
T302 - T307	+12.0 V ± 5%
T303 - T307	-12.0 V ± 5%
T304 - T307	+5.0 V ± 5%
T305 - T307	-5.0 V ± 5%

2. **Analog Ground**. Verify that the analog and digital grounds on T307 – T150are tied together. The nominal value is 0 Ω + 0.1 Ω.
3. **Reference Voltages**. Inspect the following voltages referenced to ground on T150. Nominal values are as follows:

Reference	Nominal value
T153 - T150	+5.0v ± 5%
T154 - T150	+12.1v ± 5%
T155 - T150	-1.2v ± 5%

4. **A/D converter**
   - Measure the frequency of the oscillator on the A/D converter on T156. The nominal value is 4 MHz ± 20 kHz.
   - Check the amplitude on the oscillator on T156. The nominal value is 5.0V ± 0.5V.
5. **Functional QA-1290 System Test**
   - Connect signal- and power cables to front board, step motor, compressor and valve. Turn on the power.
   - Verify in display that system runs and that SW starts.

- Verify that buzzer beeps when system starts.
- Verify that step motor first moves against cylinder, then away from cylinder on startup.
- With the unit in main menu all valves are open. Measure voltage over each valve control output:

Valve	Nominal value
1	23 V ± 5%
2	23 V ± 5%
3	23 V ± 5%

- Enter the Leak Test menu and press **INFLATE (F2)**, then **DEFLATE (F2)**. Verify that compressor starts on **INFLATE** and stops on **DEFLATE**.

6.3 Cleaning and Sterilization

The QA-1290 should not require sterilization if used as recommended. The outside of the QA-1290 may be cleaned with warm soapy water, isopropyl alcohol, or a weak bleach solution.
DO NOT ALLOW FLUIDS TO ENTER THE ENCLOSURE OF THE UNIT!

The cuff mandrels and tubing adapters may be sterilized using liquid, gas, or light techniques, if items are inadvertently contaminated.

7. Calibrating QA-1290

This chapter covers procedures for calibrating QA-1290. This is a rather simple task, since only the pressure sensor circuit needs calibration. The unit must be opened to perform the calibration.

WARNING!
HIGH VOLTAGES ARE CAPABLE OF CAUSING DEATH!

USE EXTREME CAUTION WHEN PERFORMING TESTS AND CALIBRATION. USE ONLY INSULATED TOOLS WHEN THE UNIT IS PLUGGED IN, AND THE CASE HOUSING IS OFF.

7.1 Calibration

1. Required Calibration Equipment
   - Digital voltmeter, e.g. Fluke 87
   - Pressure calibration instrument, e.g. Drück DPI-601

IMPORTANT!
BEFORE TESTING

THE QA-1290 MUST BE POWERED **ON FOR AT LEAST 30 MINUTES** PRIOR TO CONDUCTING ANY TESTING.

2. Offset Adjustment
   a. Connect - lead of voltmeter to T150 on the QA-1290 board and the + lead to T151.
   b. Power up the unit and stop at the zero adjustment menu.
   c. With a screwdriver adjust R101 (offset adjustment) until the voltmeter displays 0.000V (5mV. The display on the QA-1290 shall read 0.

4. Gain Adjustment
   a. Enter the "LEAK TEST" menu.
   b. Connect the pressure pump to the cuff connection.
   c. Reset pressure pump display to zero.
   d. Pump up the pressure to 495 mmHg (660 mBar)
   e. Adjust R100 (gain) until the display shows 495 mmHg

f. **Release pressure and verify that the display reads 0, if not: power off and repeat from step 2**.

g. Check the calibration and linearity by applying pressure of 330 mmHg (440 mBar) and 165 mmHg (220 mBar), and verify that the QA-1290 displays this value ± 1mmHg.

Pressure sensor Reference	Measured value
0 mBar (0 mmHg)	
220 mBar (165 mmHg)	
440 mBar (330 mmHg)	
660 mBar (495 mmHg)	

*Tolerance Pressure Sensor: ± 1 mmHg

5. The calibration procedure is now complete.

8. Component Functions and Parts

This chapter provides a description of the functions of the main components of the QA-1290, as well as a parts list for cross-reference.

8.1 System Overview

QA-1290 consists of three different modules inside the cabinet: processor and keypad board in the front of the cabinet; the QA-1290 board located on the left side of the cabinet bottom, and; the power supply located on the middle of the cabinet rear wall. There are also a number of pneumatic parts to generate pressure and pulses for the simulations and tests. The processor and keypad boards, with two modifications, are the same as those on the QA-90. The QA-1290 board contains drivers for valves, the step motor, the compressor and the pressure measurement circuit. It also generates the supply voltages needed in addition to +5V and +24V. Communication between the processor and QA-1290 boards is by a 16-conductor ribbon cable.

The following block diagram shows the hardware used in the QA-1290. The electronic components are found on the QA-1290 board, as well as the processor and keypad boards.

8.2 QA-1290 Pressure Measurement System

Refer to Appendix C, Drawing No. 1001-01-02, containing eight schematic diagrams.

1. **Pressure Sensor and Amplifier**. *Refer to Schematic Diagrams 1, 5 and 6 (Top Level, A/D Converter and Pressure Sensor and Amplifier.* The pressure sensor used is the Honeywell (gauge type) 136PC15G2. The sensor is based on a piezo-resistive measuring bridge. It is temperature-compensated internally, but has no built-in amplifier. It is powered with 12V, which is a reference voltage that is internally generated from the 5V-reference voltage on the A/D-converter. The voltage is generated by U102-C. The sensitivity of the pressure sensor is 128.92 µV/mmHg (6,67mV/psi). The pressure range is 0 to 775.7 mmHg (0 – 15 psi). This gives a full-scale output (FSO) of 100 mV. Initial tolerance on FSO is ± 1.5%, and for offset voltage it is max ± 1.0mV

   The amplifier takes the signal from the pressure sensor to a maximum output voltage of 5.00 V at maximum pressure. Maximum pressure is defined to be 512.0 mmHg. This gives a nominal amplification of 75.8 The amplifier used is a JFET OP-AMP, LF 347. Two multi-turn potentiometers are used for adjustment of offset and gain for the pressure sensor circuit. For offset adjustment the two reference voltages of 12.1 V and - 1.2 V is used. Offset is adjusted with R101. Gain is adjusted with R100. *Refer to Schematic Diagram 8 (Component Notation, Bottom Side).*

   The amplified signal passes through a second order low-pass **filter**. The roll-off frequency is about 15 Hz.

2. **A/D-Converter**. *Refer to Schematic Diagrams 1, 2 and 5 (Top Level, Power and A/D Converter.* The A/D-converter used is the National Semiconductor ADC12030. This is a 12 bit (plus sign) A/D with SPI-bus interface to the micro controller. The hardware SPI on the micro controller is not used, as the pins are used for other purposes. Instead the SPI is implemented in QA-1290's firmware, using ordinary I/O-port pins. The communication uses the signals **MOSI**, **MISO**, **SCKB** (SPI-signals) and **AD_CS** (chip select). For a description of the data format refer to the data sheet for the A/D-converter. The signal **AD_EOC** indicates when a conversion has finished and the data are available for retrieval from by the µC. A measurement range of 5V and 12 bit gives a resolution of $5/(2^{12}) = 1.22$mV per step. A 4 MHz oscillator generates the converter clock.

   The **Voltage Reference** for the A/D-converter is 5V. This voltage defines the range for the A/D-converter. From this reference,

a reference voltage of 12.1V and a reference of –1.2V are generated.

An **I/O-expansion** is needed to obtain the I/O for the processor. A SIPO (Serial In Parallel Out) shift register is used. The outputs of this register control three magnet valves, and a miniature air compressor, beeper, step motor (step motor inhibit signal) and dual-color LED. Note: The LED is currently not used, except for development tests.

3. **Stepper Motor Driver.** *Refer to Schematic Diagrams 1 and 4 (Top Level and Stepper Motor Driver.* The Ericcson PBD3517N is used as the stepper motor driver. The motor is run in half step mode to obtain an optimum of force and speed. The half step reduces the potential problems of resonance (increased noise for system at certain motor speeds) in the system. The driver is controlled by the signals **STEP_INHIBIT-, STEP_DIR, STEPB-** and **STEP_CNT**. These signals have the following function:

STEP_INHIBIT-:	'L' = power down, 'H' = active
STEP_DIR:	Direction of rotation
STEPB-:	Motor speed – frequency from UARTs 16-bits timer
STEP_CNT:	Counting pulses to measure motor movement

There are three **magnet valves** that are controlled via the SIPO shift register. The coils are driven by 24 V, with grounding via a ULN2003 Darlington driver output. These outputs have internal protection diodes that prevent the ULN2003 from the back voltage induced by the coil of the magnet valves when valve is released.

The miniature **air compressor** used for leak- and overpressure tests is driven by three ULN2003 Darlington driver outputs in parallel. Supply voltage to compressor is 24 V. The outputs are internally protected against back voltages from inductive loads.

A **beeper** with built-in oscillator is driven by a ULN2003 Darlington driver output, which is controlled by the shift register. The beeper voltage is 24V. In case a lower volume is desired, a serial resistor is prepared for and may be fitted on the board. The beeper is controlled with the signal BEEPER.

From the **Power** supply, the QA-1290 board gets +5V and +24V. From these the rest of the needed voltages are generated on the QA-1290 board. The following voltages are present in the system:

Voltage	Generated from	Description
+24	External Supply	Regulated 24V in
+15	+24	Local +15V analogue
+12	+24	+12V analogue for QA-90
-12	+12	-12V analogue for QA-90
+5A	+24	Local +5V analogue
-5A	+5	Local -5V analogue

Voltage	Generated from	Description
+5	External Supply	Regulated 5V in, digital 5V

8.3 Processor System

Refer to Appendix C, Drawing No. E160.20.1000.U1, containing six schematic diagrams.

The QA-1290 processor board is identical to that used by the QA-90, except for two modifications. One is that the buzzer on the processor board is not used and is not fitted. A buzzer on the QA-1290 board is used instead. The second is that Pin 3 on J60 is strapped to pin 13 on U1300 instead of +5V. This signals the pulses that step the step motor.

Refer to Schematic Diagrams 1 through 3 (QA-90; Integrated Keyboard QA-90; and CPU QA-90). The processor controls the simulations and measurements in the QA-1290. This system is divided into five function blocks comprising a CPU, memory, display and printer interface, serial and keypad interface and keypad.

The CPU and keypad board are located behind the front panel. The unit comprises a processor system, display, control components and a firmware-controlled SIP port for communication with the QA-1290 board.

The CPU comprises a Motorola 68HC11 operating at 8 MHz, which gives a BUS frequency of 2 MHz. The UART in µP is used only during boot-up. A Maxim µP supervisory circuit with a 4.65 V reset is used to monitor the 12 V power, and ensure battery power to RAM when the unit is switched off. U1080 and DS2404 are timer circuits. These provide the system with real time clock and calendar information. U1160 is an address decoder. U1120 is an address latch for the multiplex address bus. µP has a 64 KB address range, and U1130 together with U1150 are used as a bank-switch to address the process circuit's RAM and Flash-ROM.

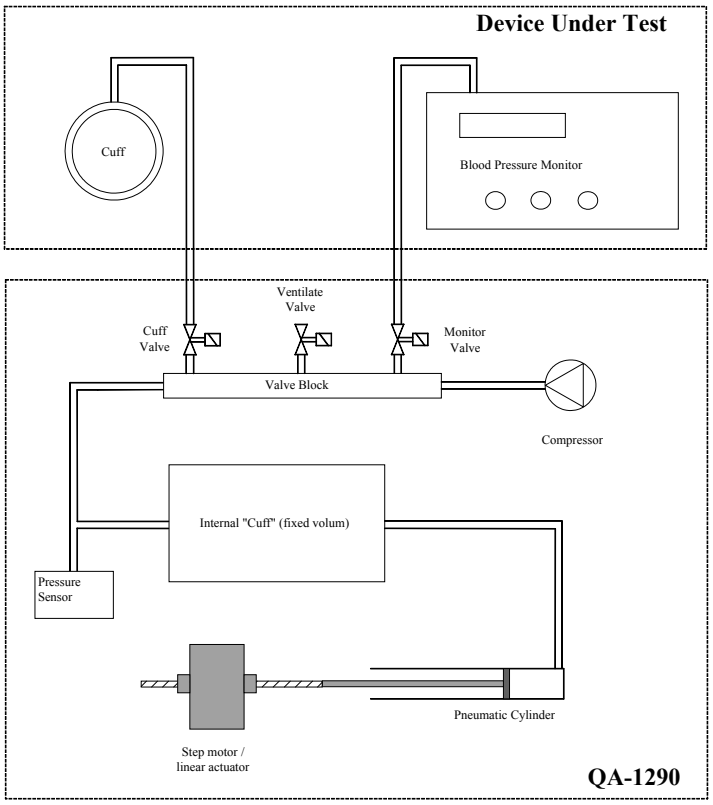
Refer to Schematic Diagram 4 (Memory QA-90). The memory component comprises 128 KB RAM and either a 28F200 or a 28F400 Flash-ROM for storing programs. The CPU module is programmable and may be re-programmed with new software supplied by Metron. Transistors in the memory circuit are used to supply the flash-ROM with a 12 volt programming voltage.

Refer to Schematic Diagram 5 (Printer and Display IF, QA-90). The printer and display interface comprises PD71055, PIO that is used to write to display and to the Centronics output. Data to Centronics goes via LS05, which has an open collector output. A strobe pulse to the Centronics port is established through U1410. Keypad scanning and the RS-232 interface are established by U1300, DUART. The keypad is a standard keypad matrix. U1310, MAX238 is an RS-232 transmitter/receiver between DUART and the RS-232 port.

8.4 Pneumatic System

The pneumatics and drivers are the QA-1290's mechanical parts that deal with the air pressure and pulse generation, and their electrical drivers. This involves the electrically operated air valves that control airflow with the cylinder and piston. These are, in turn, controlled by the stepper motor in order to generate pulses. The system is used for generating blood pressure pulses and to set up pressure for leakage test and over pressure test. The following diagram shows the QA-1290 pneumatic system's functions.

QA-1290 Pneumatic System Drawing



A miniature compressor generates the pressure needed for the Leak and Over-Pressure Cutoff Tests. It is also used during blood pressure simulations for creating minor, rapid increases in pressure to simulate that patient movement (i.e., when you press **MOTION (F3)**). Because the compressor may have a little leakage that affects the leak test, a back valve is inserted between the compressor and valve block.

The valve block has three valves to control the airflow. One connects and disconnects the blood pressure monitors to the pneumatic system. The second valve connects and disconnects the cuff to the pneumatic

system, and the third valve is used to ventilate the system in order to release pressure.

The following is a simplified explanation to illustrate the functioning of these valves during a blood pressure simulation sequence:

1. When entering a simulation start menu all valves are open, so the system is ventilated. Once the start menu is entered, the ventilate valve is then closed.
2. As the blood pressure monitor increases the pressure, the pressure sensor detects this activity. The stepper motor then starts to move the piston in the cylinder in order to simulate pulses. The length of movement is given by the number of pulses applied to the stepper motor.
3. As the pressure rises, the pulses increase in strength up to a maximum where it starts falling again. At a high pressure the pulses almost disappear. This is detected by the monitor, which then starts to release the pressure slowly while simultaneously monitoring the pulses.
4. QA-1290's firmware calculates the pulse strength on the basis of the pressure measured. This makes the pulse envelope look like the pulse envelope of a human.
5. When the monitor has found both the systolic and diastolic pressures, it releases the pressure. QA-1290 senses that the measurement is completed, displays or prints the simulated values, and ventilates the system. QA-1290 is then ready for a new simulation.

8.5 Power Supply

The Processor and QA-1290 boards are powered by the same power supply. This supply delivers +5V and +24V to the QA-1290 board. This board generates the additional voltages –5V, +12V, -12V and +15V required.

The following are specifications for the ASTEC LPT65 Power Supply used in the QA-1290:

Output Voltage	Minimum load	Maximum Load	Peak Load
+5 V	0.7 A	7 A	10 A
+24 V	0.1 A	1.5 A	3 A

This power also has a 12V output but this is not used.

Input specifications for this power are 85 – 264 VAC, 120 –370 VDC, 47 – 440 Hz, and a maximum input RMS current at 115V.

8.6 Connector Signals

1. Stepper motor

Pin out:

Pin description:

Pin no:	Signal	Description
1	MA1	Winding 1 on step motor
2	n.c.	
3	MB1	$\overline{Winding\ 1}$ on step motor
4	MA2	Winding 2 on step motor
5	n.c.	
6	MB2	$\overline{Winding\ 2}$ on step motor

2. Magnet valves

Pin out:

Pin description magnet valves:

Pin no:	Signal	Description
1	+24V	+24V after filter
2	VALVE1-3	Active LOW (GND)

3. Mini Compressor

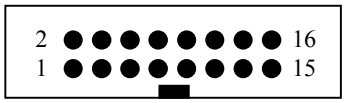
Pin out:

Pin description:

Pin no:	Signal	Description
1	+24V	+24V after filter
2	COMPRESSOR	Compressor output, active LOW

4. Processor Board

A 16 conductors ribbon cable is used for all communication between the QA-1290 board and processor board. The connector is configured as follows:



P250 pin no:	Voltage / pin	I/O	Signal name	Function
1	+5	---		
2	+5	---		
*3**	*OP3*	*O*	*STEP-*	*Step motor, step pulses*
4	PA1	I	AD_EOC	
5	PA3	O	MOSI	SPI data out
6	PA4	O	SCK	SPI clock
7	PA5	O	AD_CS	Chip Select for A/D

8	PA6	O	SHREG_LATCH	HC595 latch signal
9	PA7	I/O	STEP_CNT	Step motor, step return
10	PA2	I	MISO	SPI data in
11	PD4	I/O	SHREG_ENABLE-	Enable output driver
12	PD5	I/O	STEP_DIR	Step motor, direction
13	GND	---		
14	GND	---		
15	GND	---		
16	GND	---		

* Pin 3 on J60 on processor board is changed from +5V to signal STEP-. This signal is taken from UART U1300 pin 13 on processor board.

5. Power to Processor Board

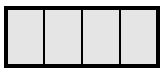
   Pin out:

   Pin description:

Pin no:	Signal
1	+12
2	+5
3	+5
4	GND
5	GND
6	÷12

6. Power to QA-1290 Board

   Pin out:



   Pin description:

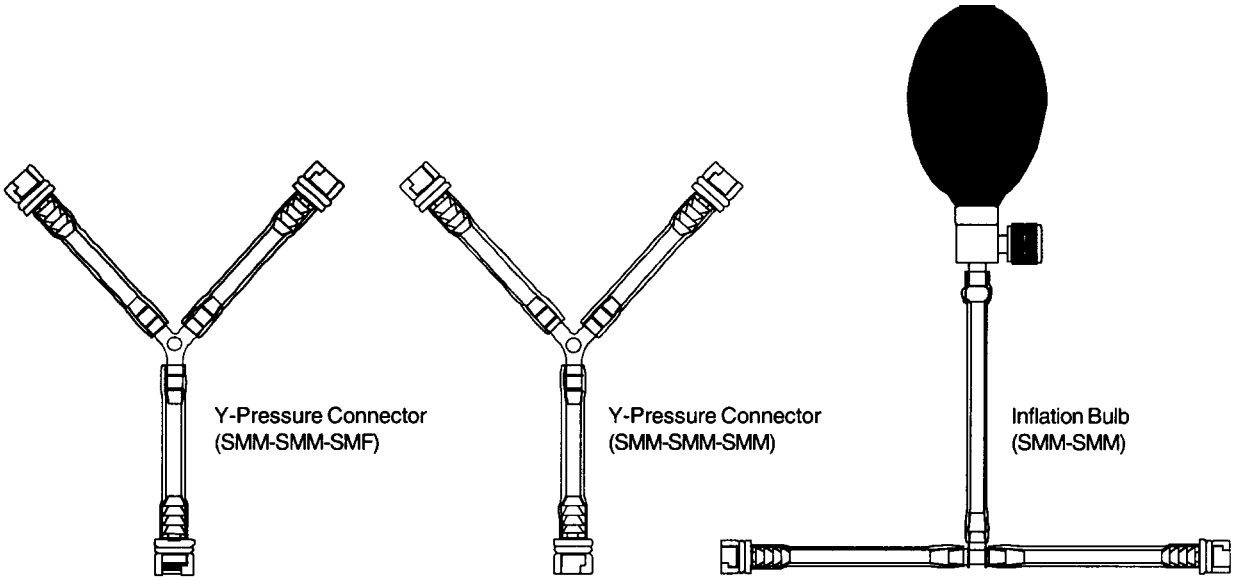
Pin no:	Signal
1	+24V in
2	GND
3	+5V in
4	GND

8.7 Component Parts

PART NO.	DESCRIPTION	QTY.	
30-4413615	136PC15G2 PRESSURE SENSOR	1	U103
99-3104003	1N4003 DIODE	3	D302-304
98+3827002	2N7002 N KANAL MOSFET SOT23	1	Q200
30-4491004	4MHZ CST4.00MGW RESONATOR 0,5%	1	X150
30+4407402	74HC02 SMD SO14	1	U203
30+4107414	74HC14 SO14 SMD IC	1	U250
30+4407432	74HC32T SMD SO14	1	U202
30+4174595	74HC595 SO16 SMD IC	1	U251
30+4474040	74HCU04 SO14 SMD IC	1	U151
30-4407806	7805 TO220 5V REGULATOR	1	U303
30-4407812	POS. 12V REG. TO220	1	U301
30-4407815	7815 TO220 +15V REGULATOR	1	U300
30+4261203	AD-CONVERTER SO16-300	1	U150
30+2803150	BLM31A601SPTM00-03 K 1206	1	L150
30-5602601	PKB24SPC-3601 PIEZO BUZZER	1	B250
30-3210270	BYV27-100 2A 100V DIODE	4	D201-204
30-2410812	1000uF 35V LXF EL.L 12,5MM	1	C300
30-2410714	100uF 35V SME-VB EL.L 8MM	8	C201, C302, C304-305, C308, C310-312
98+2502615	10uF 16V KANNE D LAV ESR	6	C150-151, C156, C200, C301, C307
98+2713210	1nF X7R 10% 0805	3	C106, C204-205
98+2713122	220pF COG 10% 0805	1	C253
C22nF-1206	22nF NPO 10% 1206	1	C111
C33pF-0805	33pF 10% 0805	2	C158-159
98+2713348	47nF X7R 10% 0805	24	C100, C102-103, C105, C108, C110, C152-155, C157, C160-161, C202-203, C209-210, C250-252, C303, C306, C309, C313
98+2713247	4.7nF X7R 10% 0805	1	C206
30-5516204	6442-04 4P KONNEKTOR	1	P300
30-5516206	6442-06 MOLEX	1	P301
30-5516102	6471-02 2P KK KONTAKT	4	P251-254
30-5516106	6471-02 6P KK KONTAKT	1	P200
30-5650016	09185166803 16P FL.K.KONT	1	P250
30-2803110	DSS306-91FZ103N100 EMI FILTER	7	L250-254, L300-301

PART NO.	DESCRIPTION	QTY.	
30-3304000	HLMP 4000 5MM LYSDIODE	1	D250
30-4407662	ICL7662CPA MAXIM	1	U302
30+4400347	LF347M OP FORST. OFM IC SO14	2	U100, U102
98+3004148	LL4148 200mA 75V SMD	2	D100-101
30+4440660	MAX660CSA OFM SO8	1	U304
30-8300900	MFR090 0,9A MULTIFUSE	1	F301
30-8302500	MFR250 2,5A MULTIFUSE	1	F300
30-3226300	P6KE30A 27-33V TRANZORB	1	D300
30-3226068	P6KE6,8A TRANSORBDIODE	1	D301
30-4401351	PBD3517N STEPPDR. DIP16	1	U200
30-4401374	PBL3774N 22P DIL	1	U201
30-2040210	POTMETER MULTITURN 1K	2	R100-101
1120000	0R 1% 0.25W 1206	1	R260
98+1120410	100K 1% 0.1W 0805	10	R103-104, R109, R154, R250-255
98+1120310	10K 1% 0.1W 0805	11	R105-108, R200-203, R256-257, R259
98+1120010	10R MOTST. KANNE 0805 1%	1	R300
98+1120315	15K 1% 0.1W 0805	1	R205
98+1120210	1K 1% 0.1W 0805	7	R122, R150, R206-207, R258, R261-262
98+1120218	1K8 MOTST. KANNE 0805 1%	1	R204
98+1120224	2K4 MOTST. KANNE 0805 1%	1	R155
98+1120227	2K7 1% 0.1W 0805	1	R102
98+1120433	330K 1% 0.1W 0805	2	R120-121
98+1120333	33K 1% 0.1W 0805	1	R152
98+1120347	47K 1% 0.1W 0805	1	R153
R5K6-1206	5K6 1206	2	R212-213
RNC-0805	NC 1% 0.1W 0805	2	R151, R211
RNC-1206	NC 1% 0.25W 1206	1	R210
30-1440056	0R56 5W AC05 5% MOTSTAND 1W	2	R208-209
TP	SOLDER TAIL 1x1 MALE STRAIGHT	16	T150-157, T300-307
30-4402003	ULN2003A 16P DIL IC	1	U252

Appendix A – Tubing Kit Components



Pressure Connector
(SMM-Clippard Male) 2 ea.

Pressure Connector
(SMM-Serto Female)

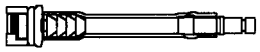
Pressure Connector
(SMM-Female Luer)

Pressure Connector
(SMM-SMF)

Pressure Connector
(SMF-SMF)

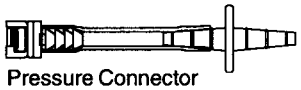
Pressure Connector
(SMM-SMM)

Pressure Connector
(SMM-Clippard Female) 2 ea.



Pressure Connector
(SMM-Serto Male)

Pressure Connector
(SMM-Male Luer)



Pressure Connector
(SMM-junction) 2 ea.

Tubing (rubber) 2 ea.

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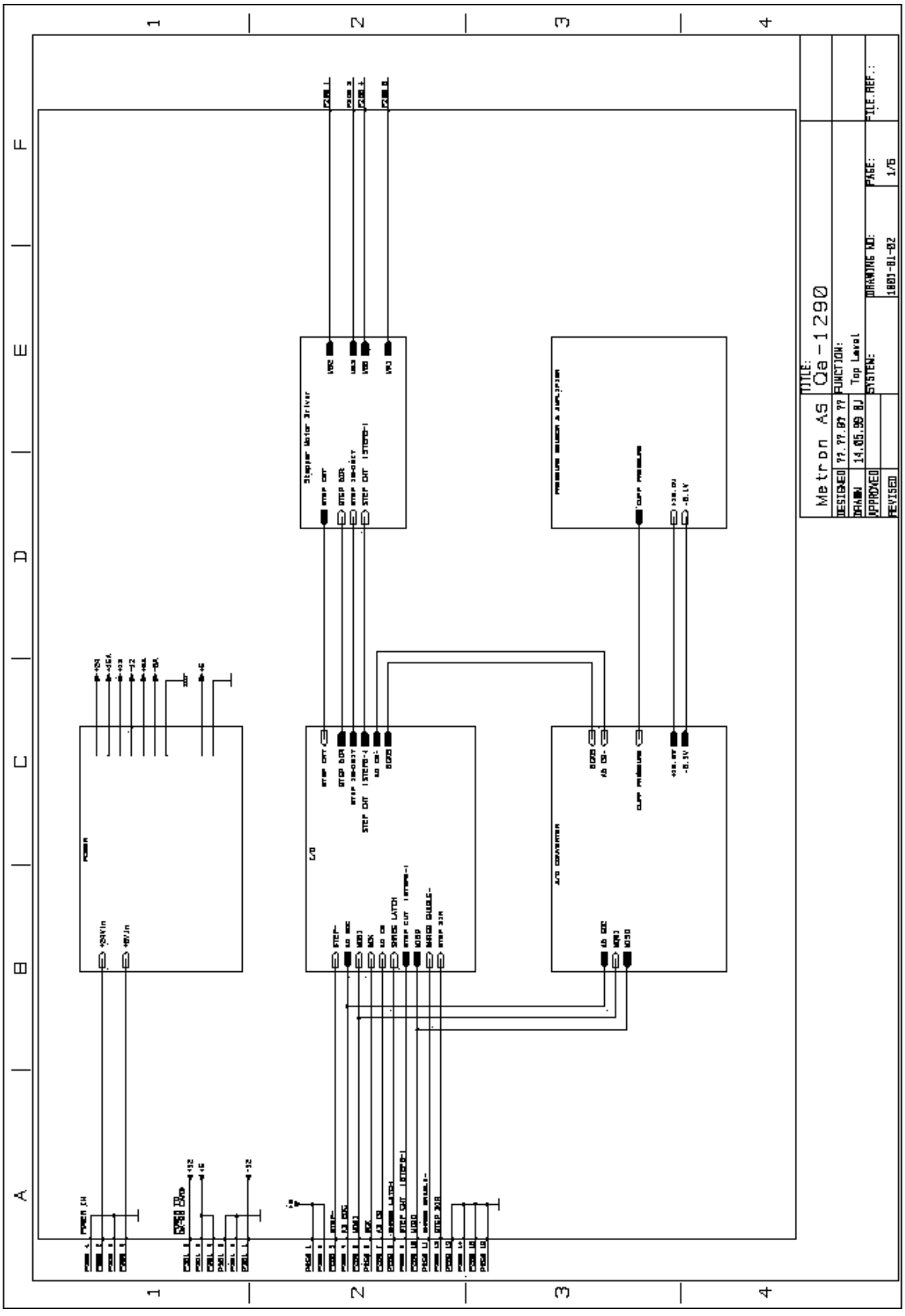
Appendix B - Schematics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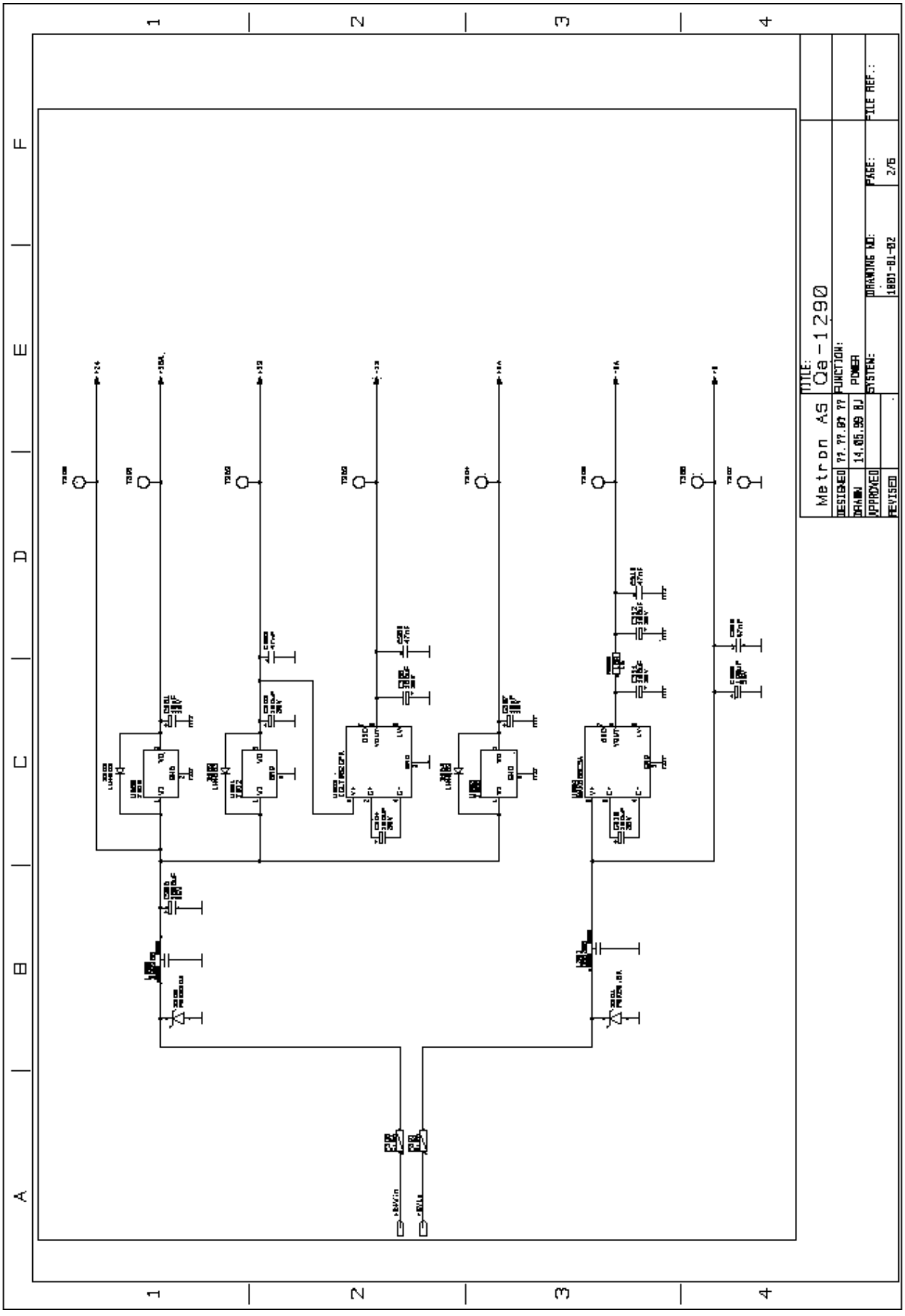
Qa-1290
DESIGNED
DRAWN
APPROVED
REVISED
FUNCTION:
Top Level
SYSTEM:
DRAWING NO:
1801-01-02
PAGE:
1/5
FILE REF.:
Stepper Motor Driver
PRESSURE SENSOR & AMPLIFIER
POWER
I/O
A/D CONVERTER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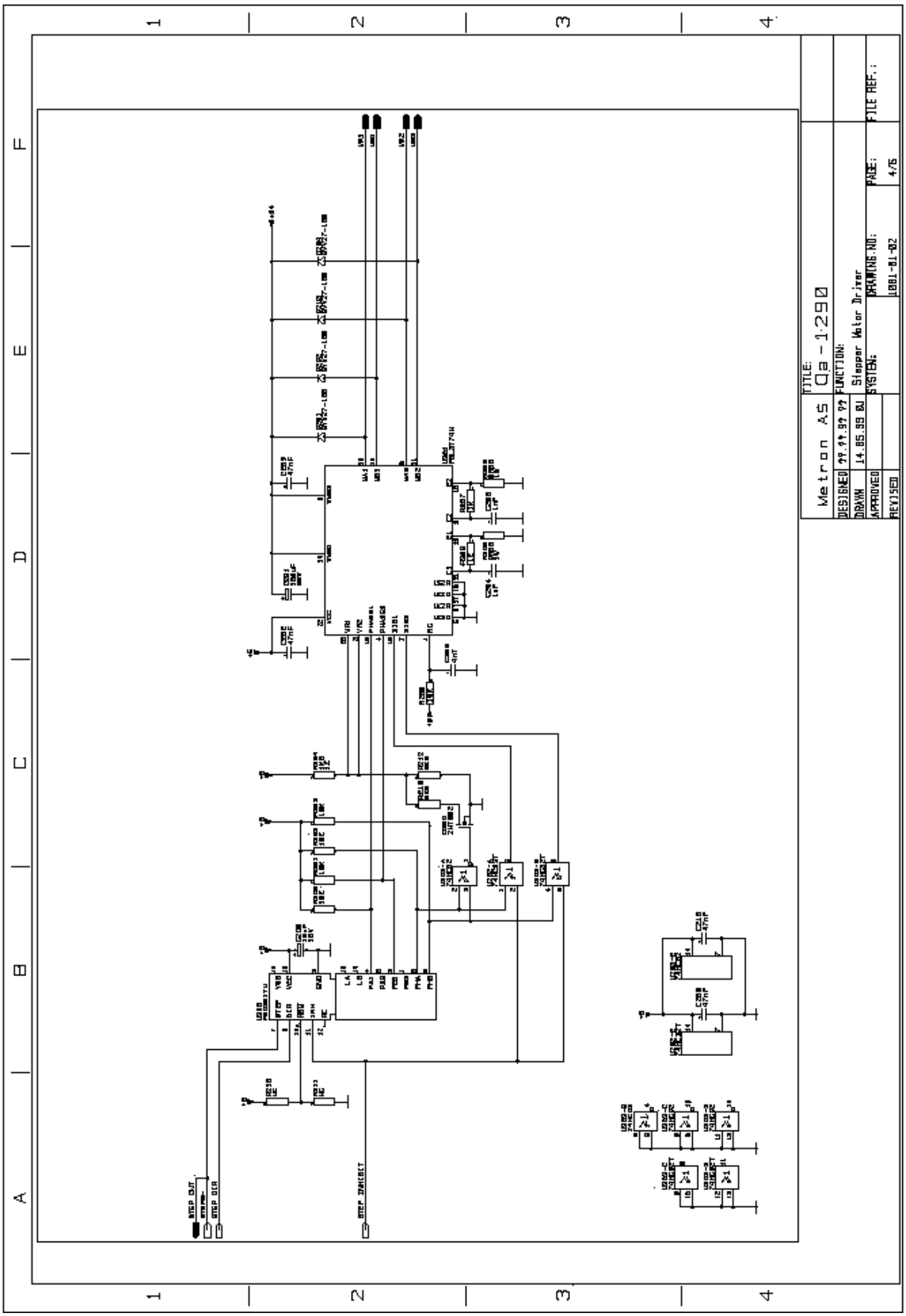
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PAGE:
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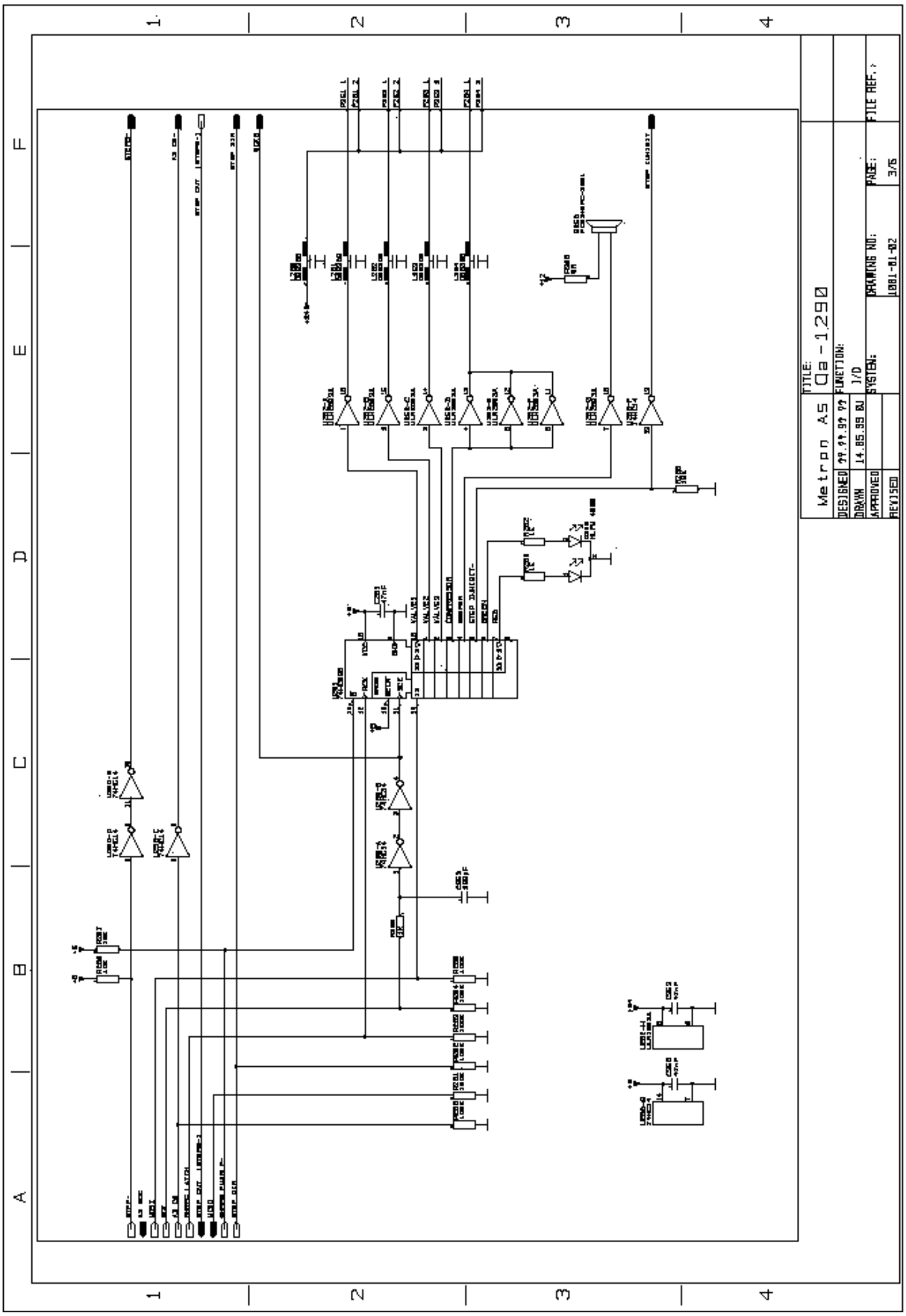
FILE REF.:
STEP OUT
STEP DIR
STEP ENABLE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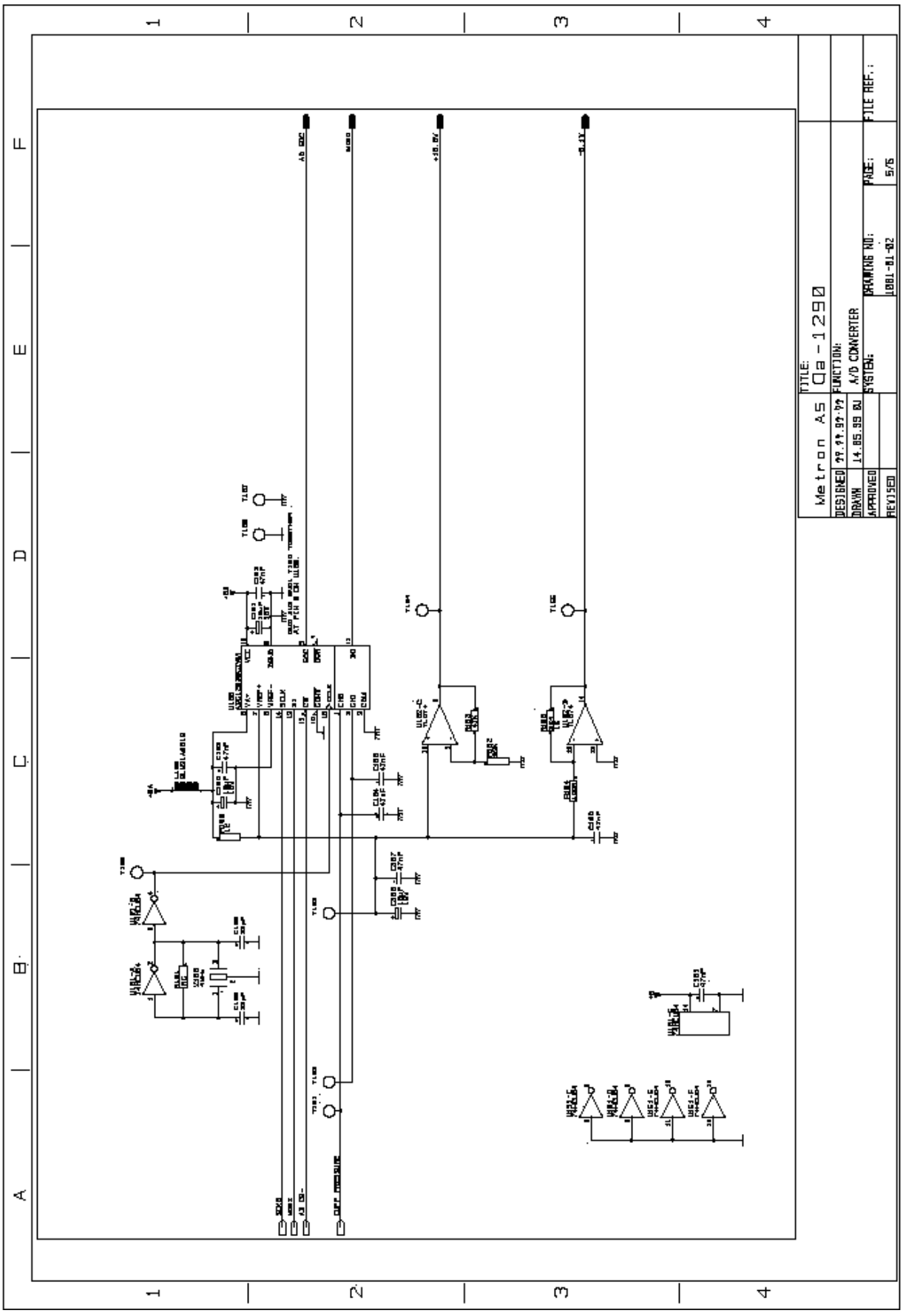
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Qa-1290
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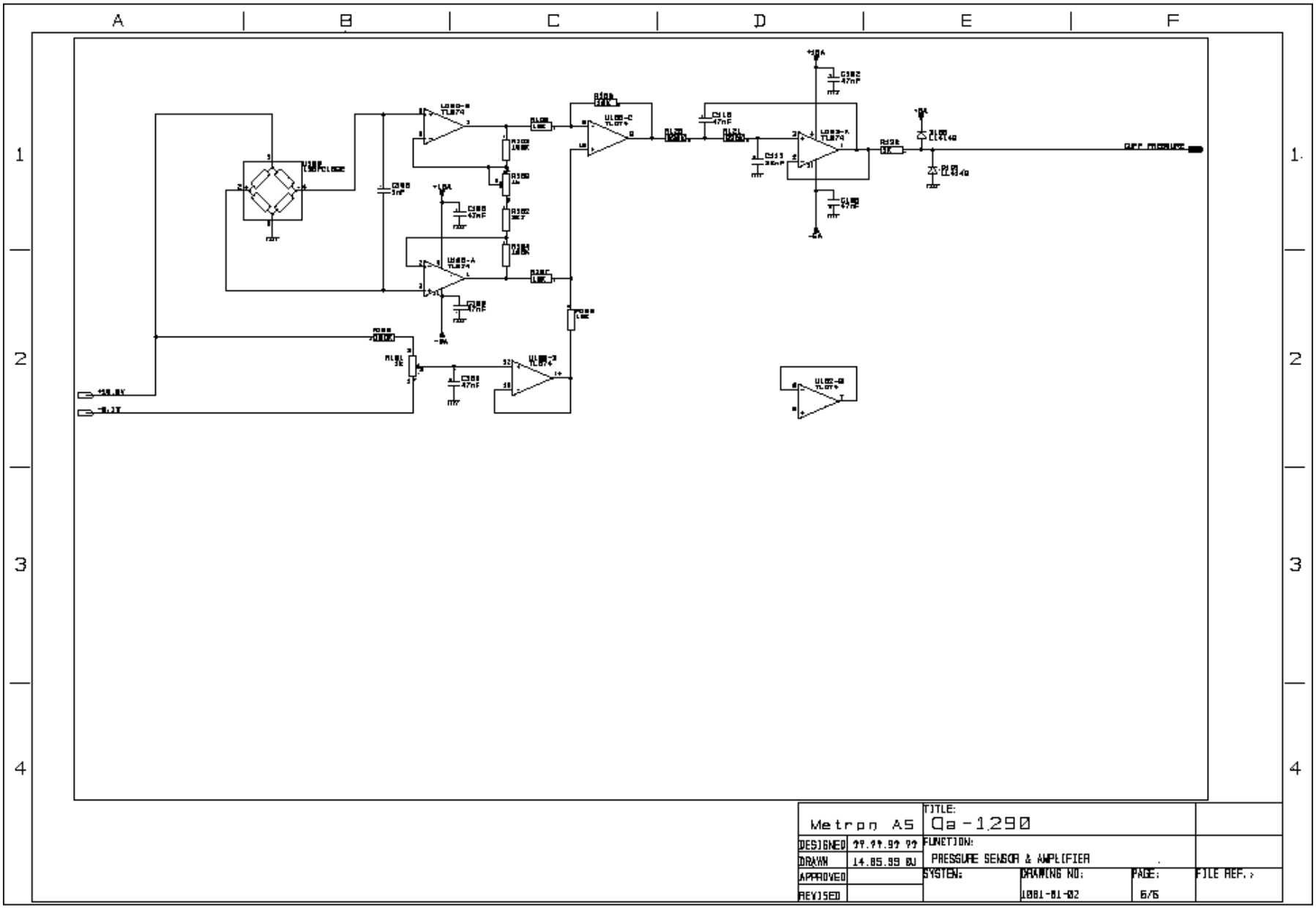
APPROVED
REVISED
FUNCTION:
A/D CONVERTER
SYSTEM:
DRAWING NO:
PAGE:
FILE REF.:
5/6



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DESIGNED	99.99.99 99	FUNCTION:		
DRAWN	14.05.99 BJ	PRESSURE SENSOR & AMPLIFIER		
APPROVED		SYSTEM:	DRAWING NO: 1081-01-02	PAGE: 6/6
REVISED				FILE REF.:

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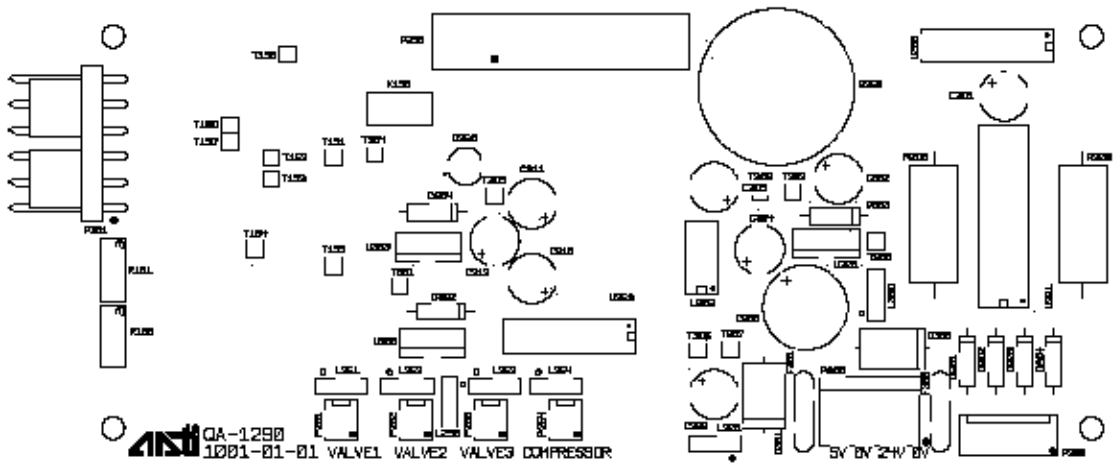
	QA-1290 1001-01-02
DATO:	98-12-07
JOBBNR:	M3286



COMPONENT NOTATION TOP SIDE
VIEWED FROM TOP SIDE

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	QA-1290 1001-01-02
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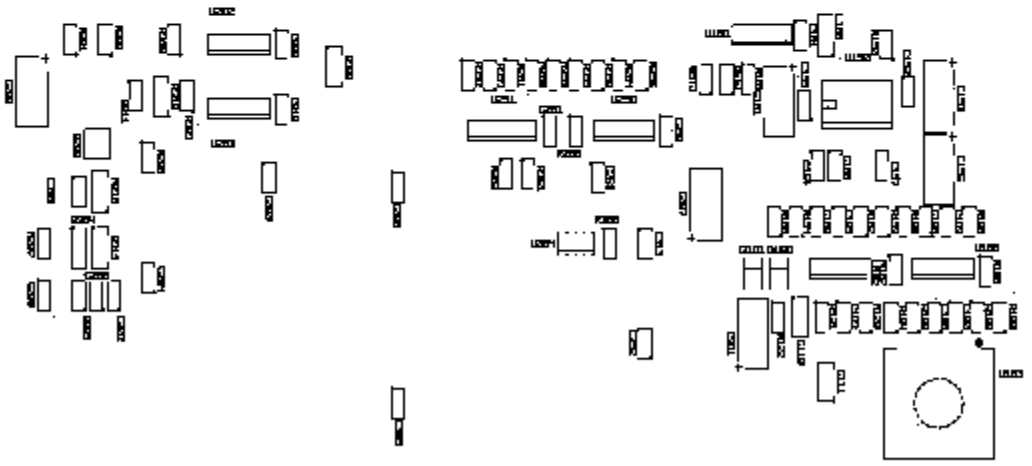
JOBBNR:	M3286



COMPONENT NOTATION BOTTOM SIDE
VIEWED FROM BOTTOM SIDE

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Fax: (+47) 7391 7009
E-mail: *support@metron.no*

METRON

From: (name) ----------
Address: ----------
---------- Phone: ----------
Fax: ----------
E-mail: ----------
Date: ----------

Error Report

Product: Version: Serial no.:

Description of the situation prior to the error:

Description of the error:

(METRON AS internally)

Comments:

Received date:	Correction date:	Ref No.	☐ Critical ☐ Normal ☐ Minor

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METRON

From: (name) ----------
Address: ----------
---------- Phone: ----------
Fax: ----------
E-mail: ----------
Date: ----------

Improvement Suggestion

Product: ---------- Version: ----------

Description of the suggested improvement:

(METRON AS internally)

Comments:

Received date:	Correction date:	Ref No.	☐ Critical ☐ Normal ☐ Minor

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