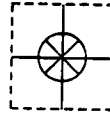


CE



User's Guide



<http://www.omega.com>

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FMA-5870A Series Control and Read Out Unit



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For immediate technical or application assistance:

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Customer Service: 1-800-622-2378 / 1-800-622-BESTSM
Engineering Service: 1-800-872-9436 / 1-800-USA-WHENSM
TELEX: 996404 EASYLINK: 62968934 CABLE: OMEGA

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It is the policy of OMEGA to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, patient connected applications.

Essential Instructions

Read This Page Before Proceeding!

OMEGA designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be read, understood and adhered to and integrated into your safety program when installing, maintaining and using OMEGA products.

- Read all instructions prior to installing, operating and servicing the product. If this instruction manual is not the correct manual, telephone 800-872-9436 and request the Flow Department. They will provide the correct manual. Save the instruction manual for future reference.
- If you do not understand any of the instructions, contact OMEGA's Flow Department for clarification.
- Follow all warnings, cautions and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation operation and maintenance of the product.
- Install your equipment as specified in the installation instructions of the appropriate instruction manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program and maintain the product.
- When replacement parts are required, ensure that qualified people use the replacement parts specified by OMEGA. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look-alike substitutions may result in fire, electrical hazards or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

WARNING:

LINE VOLTAGE (110 or 220Vac) IS PRESENT IN THIS INSTRUMENT. Service should only be performed by qualified personnel. Do not operate this instrument outside of its enclosure or without protective access panels in place. Failure to do so can result in shock or electrocution.

CAUTION:

This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling procedures must be observed during the removal, installation or other handling of internal circuit boards or devices.

HANDLING PROCEDURE:

1. Power to instrument must be removed.
2. Personnel must be grounded, via a wrist strap or other safe, suitable means, before any printed circuit assembly or other internal device is installed, removed or adjusted.

Printed circuit assemblies must be transported in a conductive bag or in another conductive container. Boards must not be removed from protective enclosure until the immediate time of installation. Removed circuit assemblies must be placed immediately in protective container for transport, storage or return to factory.

INSTALLATION:

This unit should be located in an area with a clean, dry atmosphere which is relatively free of shock and vibration.

Table Top Enclosure

1. Attach power cord to power input.
2. Attach Mass Flow cables to the D-type connectors provided.

GENERAL:

Refer to main manual for operating instructions.

WARNING

This publication must be read in its entirety before performing any operation. Failure to understand and follow these instructions could result in serious personal injury and/or damage to the equipment.

Should this equipment require repair or adjustment, contact OMEGA Customer Service. It is important that servicing be performed only by trained and qualified personnel. If this equipment is not properly serviced, serious personal injury and/or damage to the equipment could result.

This product you have just received is of the highest quality available, offering superior performance to the user. This controller provides the finest degree of accuracy, repeatability and widest operating parameters available for extremely reliable measurement and control.

In view of the wide variety of applications for mass flow measurement and control, we have expressly designed this instrument to provide user selectable functions in a single instrument to meet ever changing process conditions. Additionally, this "state-of-the-art" design has been packaged and materials were selected to permit application to a variety to often corrosive and hostile conditions.

To realize the full potential of the inherent design flexibility and ease of maintenance, may we request you to review this manual in its entirety.

Should you need additional information concerning the FMA-5870A Series Read-out/Controllers, please feel free to contact OMEGA's Flow Department. We are pleased to have this opportunity of servicing you for your measurement and control needs and hope that we will be able to help you further in the future.

CAUTION

This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling procedures must be observed during the removal, installations or other handling of internal circuit boards or devices.

HANDLING PROCEDURE:

1. Power to the unit must be removed
2. Personnel must be grounded, via a wrist strap or other safe, suitable means, before any printed circuit card or other internal device is installed, removed or adjusted.
3. Printed circuit cards must be transported in a conductive bag or in another conductive container. Boards must not be removed from protective enclosure until the immediate time of installation. Removed boards must be placed immediately in protective container for transport, storage or return to factory.

COMMENTS:

This instrument is not unique in its contents of ESD (electrostatic discharge) sensitive components. Most modern electronics designs contain components that utilize microprocessor technology (e.g. CMOS). Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.

TABLE OF CONTENTS

PARAGRAPH PAGE
NUMBER NUMBER

SECTION 1 INTRODUCTION

General description 1-1 4

SECTION 2 INSTALLATION

Receipt of Equipment 2-1 5

Return Shipment 2-2 5

Recommended storage practice 2-3 5

Jumper function and setting 2-4 5

SECTION 3 OPERATION

General 3-0 7

Description of the keys..... 3-1 8

Changing the active channel 3-2 8

Changing the setpoint value 3-3 8

Using the remote function 3-4 8

Using the blending mode..... 3-5 8

Using the control function 3-6 8

Changing the Engineering Units, Display Layout and max. Flow value 3-7 8

SECTION 4 SPECIFICATION

General Specification 4-1 10

1-1 GENERAL DESCRIPTION

The FMA-5870A Series microprocessor-based Control and Read Out Equipment has been designed to meet the highest industry standards with user-friendly operations as a primary requirement. Dual channels for model FMA-5876A and four channels for model FMA-5878A Control & Read Out Equipment are available. The above models will provide the power supply to FMA-7000E and FMA-8500 Mass Flow Meters & Controllers.

The instantaneous—two or four channels—read out function is realized by a (4x) 20 character display provided with back lighting, which ensures easy reading.

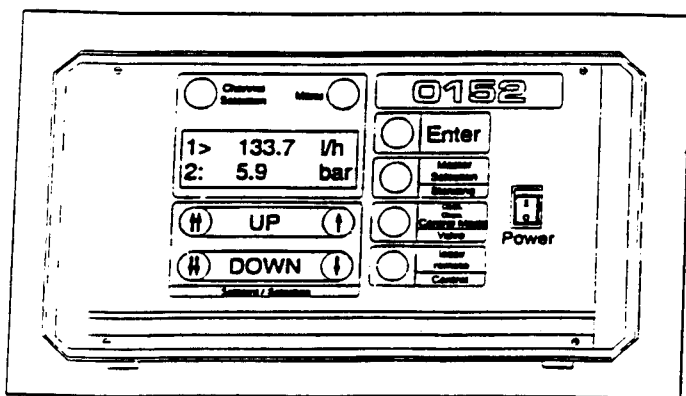
Features include membrane push buttons for setpoint, blending, valve override and local/remote control. The selected functions are clearly projected on the display. Percentage full scale or actual reading of flow/pressure units can be programmed on each channel via the Menu membrane push buttons.

They can be operated either with independent Mass Flow Control Channels, where flowrate is set through the Setpoint push buttons, or with one or more channels slaved to the master (blending mode). Each channel can be operated as master or slave or in an independent control mode.

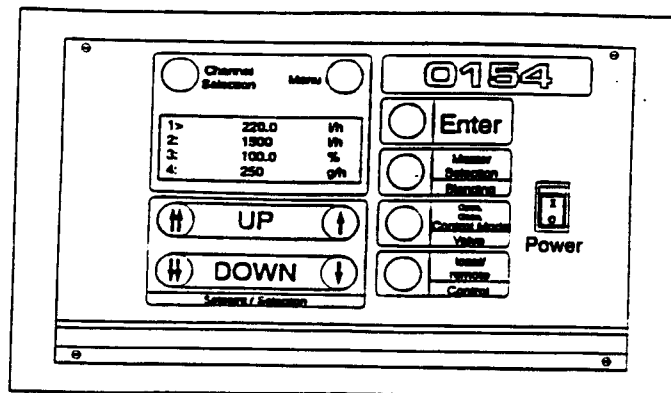
Control valve(s) functions are fully selectable. In the valve open- or close mode the valve will be driven to the selected mode independent of setpoint values. In addition during valve open- or close situations, the setpoint can be changed to prepare the MFC for the follow-on process demands. The control valve function operates accordingly to its setpoint in the "control mode".

The local control function is useful in permitting back-up of the customer's system configuration. In local mode, the Mass Flow Controllers will be operated directly by the FMA-5870A series unit, while in the remote mode the customer's (own) peripheral equipment determines the control actions. The Mass Flow Controller Output Signals are "switched" to the 25-pin connector, located on the back panel. This connector includes up to four (4) channels setpoint input and flowrate or pressure output.

0-5 Vdc input/output(s) are available.



Model FMA-5876A
Dual channel Read Out & Control Equipment



Model FMA-5878A
Four channel Read Out & Control Equipment

Section 2 INSTALLATION

2-1 RECEIPT OF EQUIPMENT

When the equipment is received, the outside packing case should be checked for any damage incurred during shipment.

If the packing case is damaged, the local carrier should be notified at once regarding his liability. A report should be submitted to the OMEGA Customer Service Department.

Remove the envelope containing the shipping list. Carefully remove the equipment from the packing case. Make sure spare parts are not discarded with the packing material. Inspect for damaged or missing parts.

2-2 RETURN SHIPMENT

Do not return any assembly or part without an authorized return number (AR) from our customer service department.

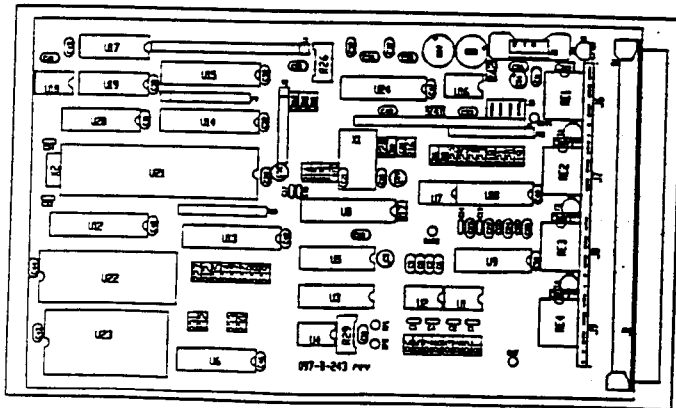
Information describing the problem, corrective actions, if any, and the work to be accomplished at the factory must be included.

2-3 RECOMMENDED STORAGE PRACTICE

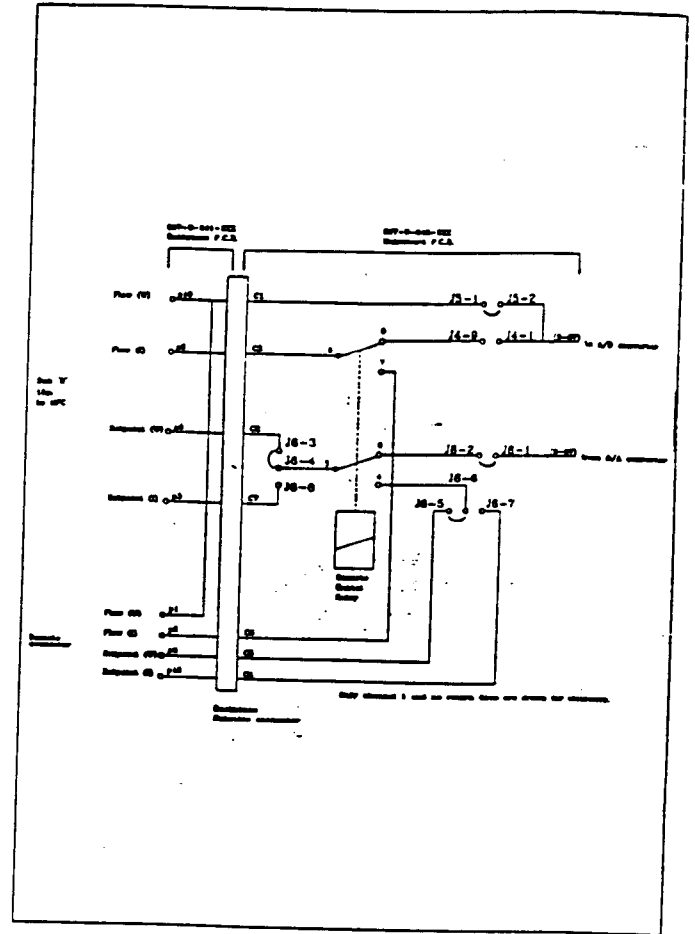
If intermediate or long term storage is required for equipment, it is recommended that said equipment be stored in accordance with the following:

1. Within the original shipping container.
2. Stored in a sheltered area, preferably a warm dry heated warehouse.
3. Ambient temperature (21°C. Nominal, 32°C. max., 7°C. min.)
4. Relative humidity 45% nominal (60% max., 25% min.)

Upon removal from storage, a visual inspection should be conducted to verify the condition of equipment is "as received".



P.c. board lay-out p/n 097- B-243-ZZZ



Jumper location

2-4 JUMPER FUNCTION AND SETTINGS

Jumper J4,

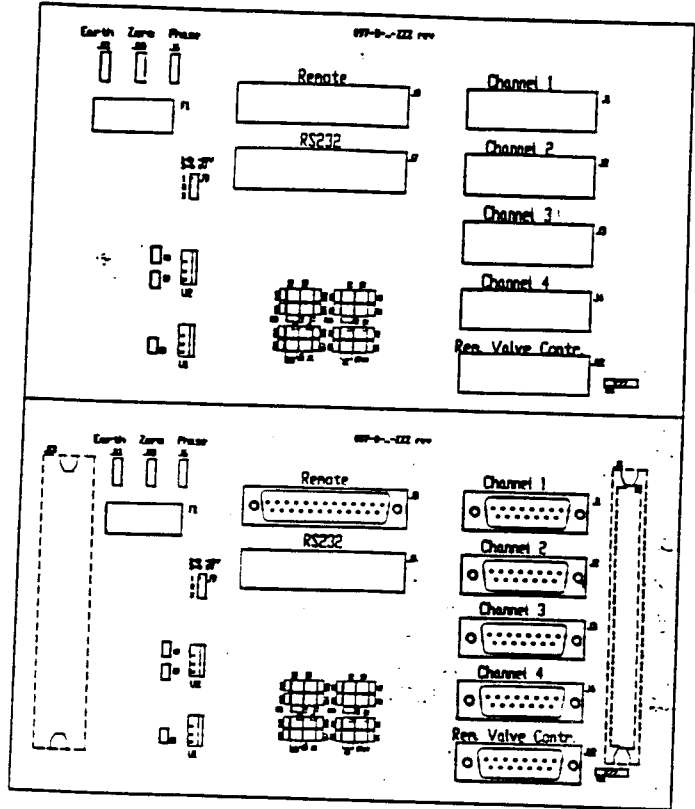
pin	Description	
1	Ch1, flow to A/D, 0-5V	to Main Board
2	Ch2, flow to A/D, 0-5V	to Main Board
3	Ch3, flow to A/D, 0-5V	to Main Board
4	Ch4, flow to A/D, 0-5V	to Main Board
5	Ch1, Signal ground	to Main Board
6	Ch2, Signal ground	to Main Board
7	Ch3, Signal ground	to Main Board
8	Ch4, Signal ground	to Main Board
9	Ch1, flow 0(4)-20 mA	to Piggy Back
10	Ch2, flow 0(4)-20 mA	to Piggy Back
11	Ch3, flow 0(4)-20 mA	to Piggy Back
12	Ch4, flow 0(4)-20 mA	to Piggy Back
13	+10V	to Piggy Back
14	+5V	to Piggy Back
15	GND	to Piggy Back
16	-9V	to Piggy Back
17	GND	to Piggy Back
18	AGND	to Piggy Back
(No jumper for 0-5 Vdc application)		

pin Description	
1	Channel 1, flow in (U) to Piggy Back
2	Channel 1, flow to A/D conv., 0-5V to Main Board
1	Channel 2, flow in (U) to Piggy Back
2	Channel 2, flow to A/D conv., 0-5V to Main Board
1	Channel 3, flow in (U) to Piggy Back
2	Channel 3, flow to A/D conv., 0-5V to Main Board
1	Channel 4, flow in (U) to Piggy Back
2	Channel 4, flow to A/D conv., 0-5V to Main Board
Default jumper settings (0-5V): 1-2, 3-4, 5-6, 7-8	

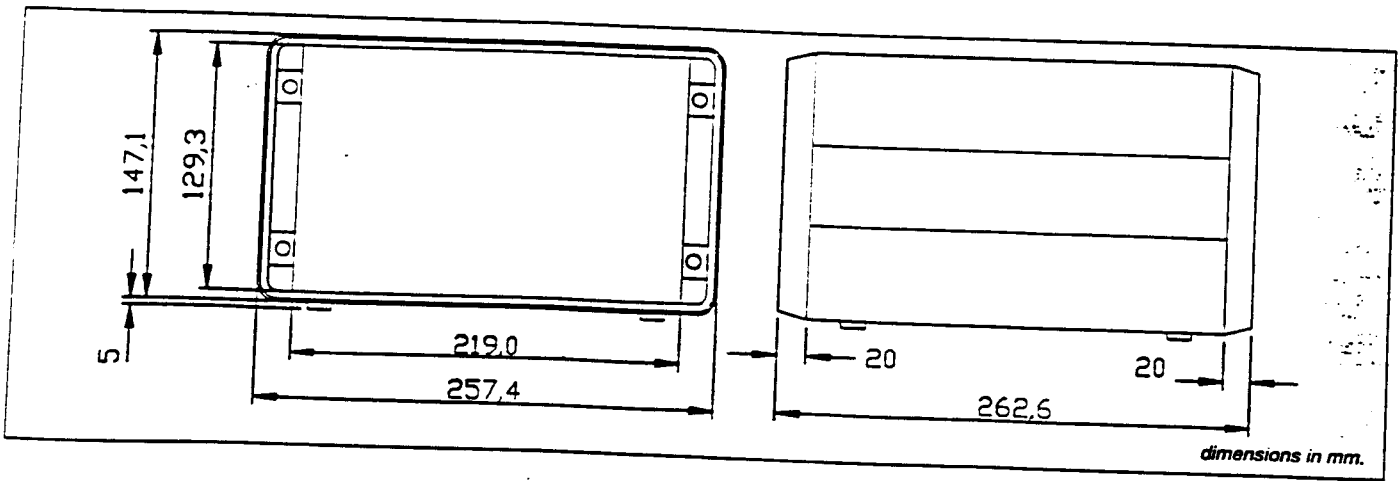
Jumper J6 (Channel 1)

pin	Description
1	Local setpoint U to Piggy Back
2	Local setpoint U or I to Main Board
3	Setpoint U to Main Board
4	Local/Remote setpoint U or I to Piggy Back
5	Remote setpoint U to Piggy Back
6	Remote setpoint U or I to Main Board
7	Remote setpoint I to Piggy Back
8	Setpoint I to Main Board
Default jumper settings (0-5V): 1-2, 3-4, 5-6, 7&8 open	

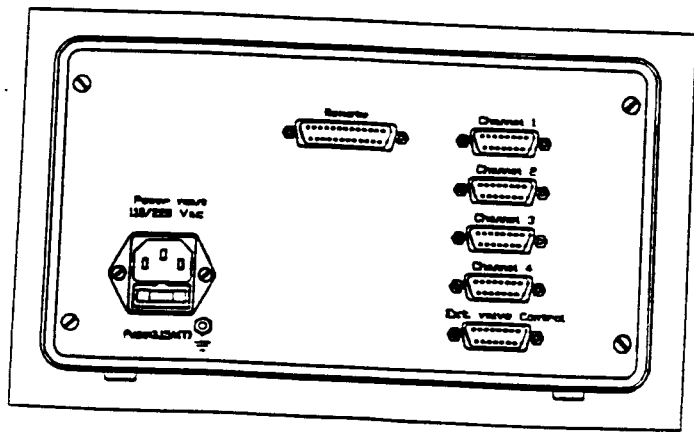
J7 is identical to J6, only for channel 2.
 J8 is identical to J6, only for channel 3.
 J9 is identical to J6, only for channel 4.



Location and connector functions



dimensions in mm.



Backpanel
 Table Top model: Four channel Read Cut & Control Equipment

D-CONNECTOR	
PINS	FUNCTION
1	Volt output channel 1
2	mA output channel 1
3	Volt output channel 2
4	mA output channel 2
5	Volt output channel 3
6	Volt output channel 4
7	mA output channel 3
8	Rem. setp. channel 1
9	Rem. setp. channel 2
10	mA output channel 4
11	Rem. setp. channel 3
12	-
13	Rem. setp. channel 4
14	Outp. return channel 1
15	Rem. mA input channel 1
16	Outp. return channel 2
17	Rem. mA input channel 2
18	Outp. return channel 3
19	Outp. return channel 4
20	Setp. return channel 1
21	Setp. return channel 2
22	Rem. mA input channel 3
23	setp. return channel 3
24	Rem. mA input channel 4
25	Setp. return channel 4

Remote connector

Remote Valve Override connector

pin	Description
1	Valve control output, channel 1
2	n.c.
3	Valve control output, channel 2
4	n.c.
5	Valve control output, channel 3
6	n.c.
7	Valve control output, channel 4
8	n.c.
9	+15V/+24V
10	n.c.
11	n.c.
12	n.c.
13	n.c.
14	n.c.
15	-15V/GND

Section 3 OPERATION

3-0 GENERAL

The read-out function of the FMA-5870A series boxes and the controlling of the Mass Flow Controllers/Meters are designed for fast and easy usage. Basically, the flow output signals are shown on the display in percentage or in your own engineering units (full scale value and flow parameters can be adjusted per channel).

If a confirmation takes too long after a change of any setting, the display will return automatically to its flow read-out function. The only exception to this rule are adjustments in the menu (see 3.3).

The FMA-5876A uses 2 x 20 characters and the FMA-5878A uses 4 x 20 characters for flow output and other relevant information.

3-1 DESCRIPTION OF THE KEYS

1. Channel selection

This key allows you to select the next channel to be active for any changes, like setpoint, blending, remote control or valve control. The last selected channel will remain "active" until this key is pressed.

After Power Up, channel 1 is always "active".

2. Menu

With this key you enter into the menu mode.

3. Up / down

In normal operation; changing the setpoint value.

In menu mode; select a menu.

In blending mode; select master channel.

4. Enter

Confirmation of selected setpoint value, master channel (blending), remote or local, valve function (valve control), certain menu, display layout or engineering unit.

5. Blending

Selects master channel in relation to setpoint value.

6. Valve

Select valve open or close or normal operation mode.

7. Control

Select local or remote controller function.

3-2 CHANGING THE ACTIVE CHANNEL

After power-up channel 1 is always active. This is indicated on the display by an ">" character after the channel number instead of an ":" character. All other functions, except the menu function, will adjust the settings on channel 1. If the settings of another channel must be changed, press "Channel Selection" until the required channel is displayed. This channel then remains active.

3-3 CHANGING THE SETPOINT VALUE

If the setpoint value of a certain channel has to be changed, this channel should be made active first. After pushing one of the setpoint keys, the display read-out of that channel changes from flow reading to the setpoint value. If no other key is pressed within approx. 5 seconds, the display read-out falls back into flow reading. (No changes are made).

In case one of the setpoint keys is pressed several times, the setpoint value changes. This change of setpoint value will be activated after a confirmation. If no confirmation is given, by pressing the Enter key, the setpoint value will not be changed. After a confirmation, the new setpoint value will be sent to the MFC.

The double up / down keys change the setpoint in steps of 2% of full scale, the single up / down keys change the setpoint of full scale, the single up / down keys change the setpoint in steps of 0.1% of full scale.

3-4 USING THE REMOTE FUNCTION

If remote control of the MFC is necessary, this function can be achieved by the "Remote" key. If this key is pressed, the flow read-out information on the display changes to "remote", which will remain visible on the display after a confirmation.

From remote control to local is just the same. After pressing the remote key, the display asks for confirmation to switch back to local control and local reading is activated again.

3-5 USING THE BLENDING MODE

In the blending mode, the setpoint of the blended channel depends on the flow value of a master channel. With this generation Read-out & Control Electronics all channels can be programmed to follow any other (master) channel.

After pressing the blending key, a "B" appears on the display of the active channel. After this "B" a number is displayed. (A "0" after the "B" means no master channel). This is the "master" channel to follow by the current active channel. This "master" channel can be changed by using the up / down keys. If the correct "master" has been selected, the "Enter" key must be pressed to confirm this new situation.

This new situation will be stored in the memory, even after a power shut-down. When the system is powered up again, the blending configuration is still active. All setpoints of the slave channel(s) are unchanged, except the setpoint of the master channel(s); this setpoint is set to zero after a power up.

3-6 USING THE VALVE CONTROL FUNCTION

With the Valve control function the valve of the connected Mass Flow Controller can be opened, to purge the system, or closed, to shut off the system, independent of the setpoint value.

After pushing the "Valve Control" key a "V" appears on the display of the active channel. After this "V" a second character is displayed to indicate the possible function. By pressing the "Valve Control" key again the other function characters are shown, a "." or the "0". The "0" stands for "no valve control function" or "valve control off" and the "." stands for valve close or shut off the flow.

3-7 CHANGING THE ENGINEERING UNITS, DISPLAY LAYOUT AND MAX. FLOW VALUE.

Changing the engineering units, the display layout or the max. flow value is a "one time" function. During these adjustments the flow can not be read from the display.

After pressing the "Menu" key there are three selection possibilities. Using the up and down keys and the "Enter" key one of the options can be entered.

If other engineering units are wanted there are more than 60 engineering units available, including pressure units, to represent your setpoint or flow. Use the up and down keys to select the desired engineering unit. For each channel a different engineering unit can be selected.

Also, the maximum flow value or full scale flow range can be changed instead of the standard 100.0 (from %). If a channel has an engineering unit other than %, the max. flow value can be changed by the up and down keys. For every channel a different value can be programmed.

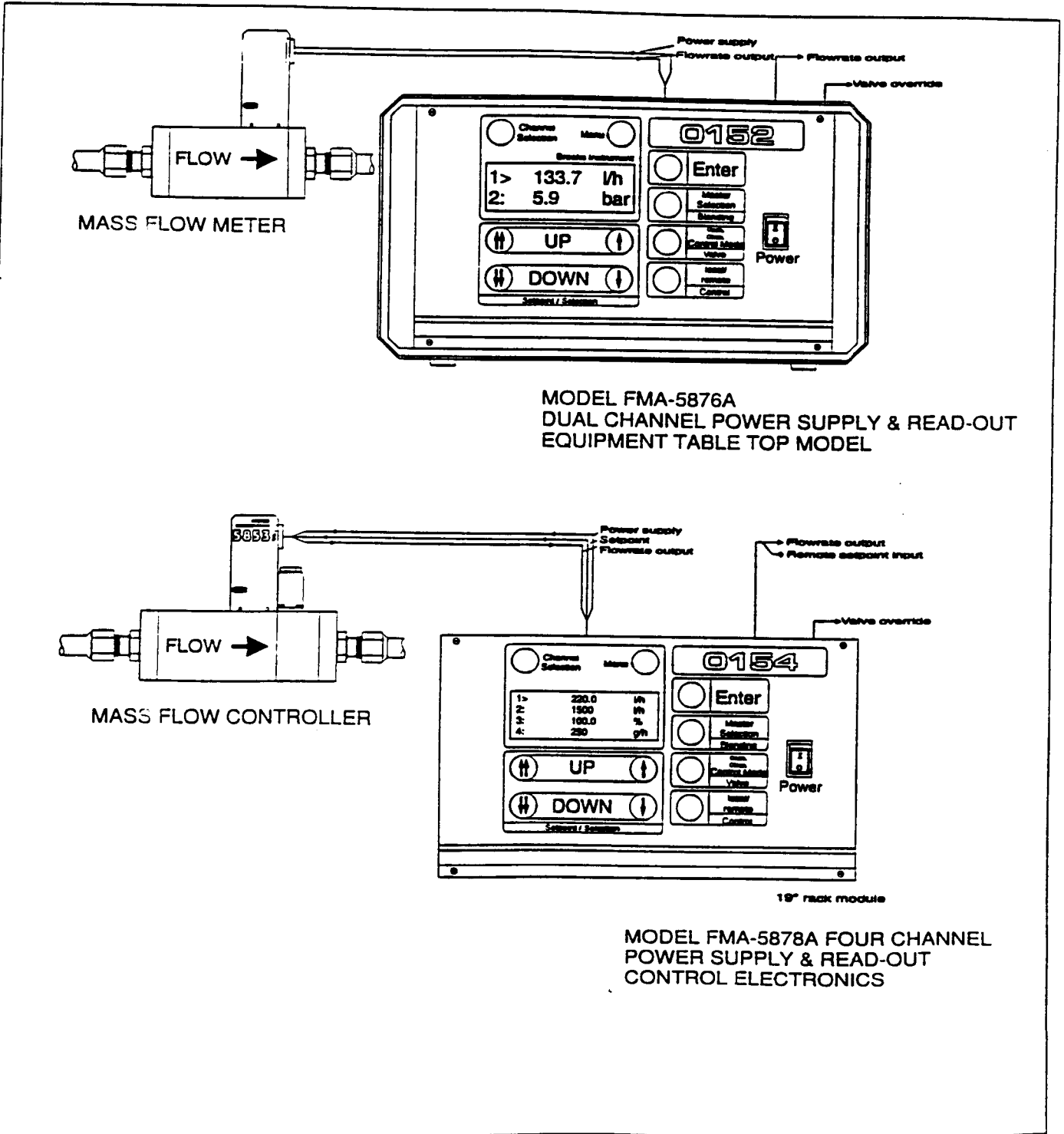
As a default, with percentage display, the display

layout is xxx.x. This is 100.0 with percentage. With the display layout menu the dot can be shifted with the up- and down keys to create a representative value.

Please notice that the accuracy of the Read-out & Control Electronics is 0.2% of max. flow. For example if the max. flow value is adjusted for 950, then it is not useful to have a figure after the point. However if 1.5 is the max flow value, then two or three figures after the decimal point are useful.

After a confirmation of the changes, made with the 'Enter' key, the display returns to its basic task; to display the flow value in the engineering unit you want.

BLOCK DIAGRAM



Section 4 SPECIFICATION

4-1 GENERAL SPECIFICATION

power input range 90 - 260 Vac. 50/60 Hz,
60W max power

Power output + 15 V/2.9 A, -15 V/1.4 A max or
24 Vdc/2.5 A max.

Signal input (signal from flow and remote setpoint) 0 - 5 Vdc

Signal output 0 - 5 Vdc Impedance 1 k Ω

Electrical

- One 25-pins D-type connector for combined remote setpoint input-and output signal; up to four (4) channels. Mating connector is included
- 15-pins D-type connector for Remote Valve Override function up to four (4) channels
- Two, or four 15 pins D-type connector for connecting the Mass Flow Equipment

Display reading

- For model FMA-5876A, 2x 20 character and model FMA-5878A, 4x 20 character display with back lighting.
- For model FMA-5876A, 2x 20 character Percentage full scale or actual reading.

controls Membrane push buttons for setpoint, blending, valve control function, local/remote control, menu selection per channel including enter (confirmation) and power switch.

casing Anodized aluminium and steel covers: table top with optional handgrip.

ambient temperature 0 - 50°C

NOTES

NOTES

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

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

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

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

RETURN REQUESTS / INQUIRIES

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

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

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

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

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

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

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

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- Wire: Thermocouple, RTD & Thermistor
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- Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- Transducers & Strain Gauges
- Load Cells & Pressure Gauges
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL

- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY

- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION

- Data Acquisition & Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Datalogging Systems
- Recorders, Printers & Plotters

HEATERS

- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments