

Installation and Maintenance Manual

MeasureTrol

Pressure Control & Steam Metering Valve

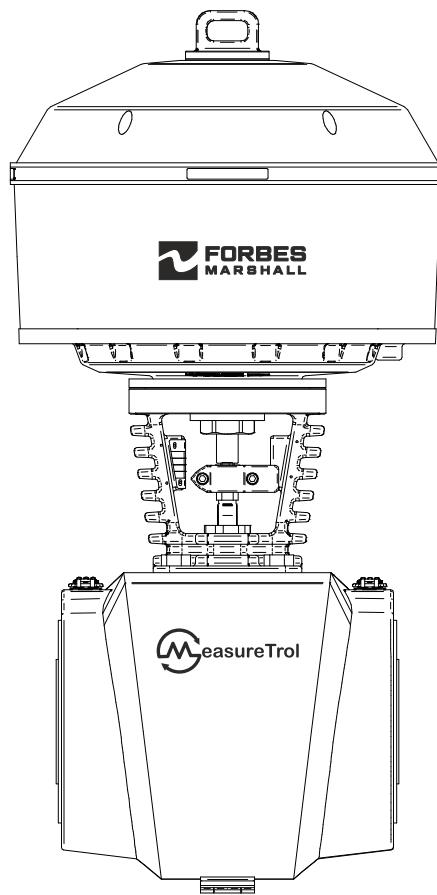


Table of Contents

1.	Preface	1
2.	Safety Information.....	1
3.	General Product Information.....	4
4.	Working Principle	7
5.	Installation and Commissioning.....	9
6.	Trouble Shooting.....	40
7.	Maintenance Guidelines	42
8.	Spares Parts	53
9.	Warranty Period.....	60

PLEASE NOTE - Throughout this manual this cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked. This symbol denotes CAUTION, WARNING or DANGER.



1. Preface:

This manual is intended for anyone using, commissioning, servicing, or disposing the below mentioned products safely and efficiently.

MeasureTrol

Size: DN 15 (½"), DN 20 (¾"), DN 25 (1"), DN 40 (1 ½"), DN 50 (2"), DN 65 (2 ½"), DN 80 (3") and DN 100 (4").

PLEASE NOTE:

Throughout this manual the following cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked.

2. Safety Information:



In current scenario, every industry requires safe operation of products. Safe operation of these products can only be guaranteed if they are properly installed, commissioned, used and maintained by qualified personnel (see Section 2.10) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

2.1 Intended use:

Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended use / application. The products have been specifically designed for use with steam which are in Groups 1 and 2 of the above mentioned Pressure Equipment Directive. Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or over temperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations. Determine the correct installation situation and direction of fluid flow.

System to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimize them. Remove protection covers from all connections and protective film from all name-plates, where appropriate, before installation on steam or other high temperature applications.

2.2 Access:

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required..

2.3 Lighting:

Ensure adequate lighting, particularly where detailed or intricate work is required.

2.4 Hazardous liquids or gases in the pipeline and hazardous environment around the product.

Consider: what is in the pipeline or what may have been in the pipeline at some previous time.

Consider: flammable materials, substances hazardous to health, extremes of temperature. Hazardous environment around the product.

Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits, columns), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

2.5 The system:

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at the risk?

Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks..

2.6 Pressure systems:

Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labelling of closed valves. Do not assume that the system has depressurized even when the pressure gauge indicates zero.

2.7 Temperature:

Allow time for temperature to normalize after isolation to avoid the danger of burns and consider whether protective clothing (including safety glasses) is required.

PTFE SEALS

If seals made from PTFE have been subjected to a temperature approaching 260°C (500°F) or higher, they will give off toxic fumes, which if inhaled are likely to cause temporary discomfort. It is essential for a no smoking rule to be enforced in all areas where PTFE is stored, handled or processed as persons inhaling the fumes from burning tobacco contaminated with PTFE particles can develop 'polymer fume fever'.

2.8 Tools and consumables:

Before starting work ensure that you have suitable tools and / or consumables available. Use only genuine Forbes Marshall replacement parts.

2.9 Protective clothing:

Consider whether you and / or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high / low temperature, radiation, noise, falling objects, and dangers to eyes and face.

2.10 Permits to work:

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions.

Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety. Post 'warning notices' if necessary.

2.11 Handling:

Manual handling of large and /or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

2.12 Residual hazards:

In normal use the external surface of the product may be very hot. If used at the maximum permitted operating conditions the surface temperature of some products may reach temperatures of 538°C (1000°F).

Many products are not self-draining. Take due care when dismantling or removing the product from an installation (refer to 'Maintenance instructions')

2.13 Freezing:

Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

2.14 Disposal:

Unless otherwise stated in the Installation and Maintenance Instructions, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken. However, if the valve is fitted with a Viton or PTFE seat, special care must be taken to avoid potential health hazards associated with decomposition / burning of these seats.

PTFE:

Can only be disposed of by approved methods, not incineration.

Keep PTFE waste in a separate container, do not mix it with other rubbish, and consign it to a landfill site.

It is necessary to dispose this product only in accordance with local regulations at the authorized, qualified collecting point specified for equipment and its parts. Kindly refer to the components mentioned in this document. Please follow all waste disposal guidelines (Management & Handling) as published by local governing authorities and local environmental laws.

IMPORTANT

Read this Service Manual thoroughly and understand its contents completely before installing and powering-up the **MeasureTrol** unit.

2.15 Returning products:

Customers and stockiest are reminded that under EC Health, Safety and Environment Law, when returning products to Forbes Marshall they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous..

3. General Product Information :

The MeasureTrol is a pre insulated pressure reducing valve for steam applications with an inbuilt smart pressure controller. This is a four-wire device that communicates via a mobile app-based Bluetooth and / or PC based configurator on RS485 Modbus. The device is powered by a 24VDC input. It compares the setpoint with the actual pressure of the process and controls the pressure accurately using an internal PID control action. It also displays indicative steam flow on mobile app / PC configurator / Remote display unit .

Size and End Connections

End connections : Flanged (#150)

Size available : DN15, 20, 25, 40, 50, 65, 80 & 100

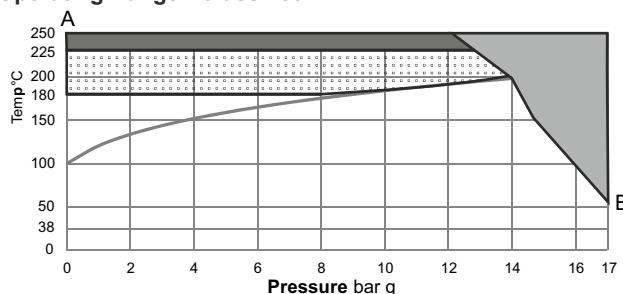
Available with IBR on request

Limiting Condition

Body Design Condition	#150
Max Allowable Design Pressure	13 bar (g)
Max Allowable Design Temperature	225 °C
Min. Allowable Design Temp	-10 °C
Maximum Cold Hydraulic Test Pressure	26 barg
Max Operating Temp (Standard Metal seat)	200 °C
Max Operating Temp (Soft seat)	180 °C

Operating Characteristic - Equal percentage / Linear

Operating Range - Class 150



A – B SG Iron PT rating curve ASME B16.42

The product must not be used in this region.

Class 150 valves are PTFE packing valves and hence are limited to a maximum operating temperature 225 °C
SOFT seated valve must not be used in this region.

Positioner Details

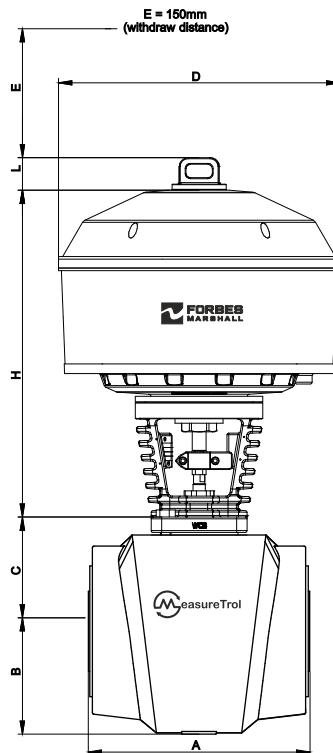
Positioner type	Single Acting Linear
Position sensing	Resonant non-contact LVDT
Stroke length	16 to 30mm
Valve characteristics	Linear / Equal %
Indicative flow	Calculated flow as per design size. Units: kg/h (default) or T/h
Control input (SP)	Pressure setpoint via mobile app / PC
Sensitivity	± 0.5% with valve
Linearity	± 1% of span with valve
Hysteresis	± 1% of span with valve
Overall control accuracy	±1%
Display	Optional
User input	Via MODBUS / Bluetooth® / Display
Input power supply	20~30 VDC
Current consumption	Min. 500mA @ 24VDC, Min. 630mA @ 20V, Min. 400mA at 30V
LED indication	Red : Error, Green: Healthy
Operating temperature (electronics)	[-] 10°C to [+] 70°C
Pneumatic input	1.5 to 7 bar pressure
Air consumption	< 0.5 LPM (0.03 m³/h)
Air capacity	>130 LPM (7.8 m³/h) @ 6 bar
Air quality	Filtered with a 5 micron filter Dried according to ISO8573-1: 2010 Class 3.3.3 or ISA S7.0.01 Humidity: Class 1
Communication	MODBUS RS485 / Bluetooth® / Remote Display Unit
Configurator	Mobile app / PC configurator
Cloud connectivity	Via RTru
Enclosure	
Housing MOC	Polycarbonate
Dimensions	Refer Image (Fig.-1)
Connections	
Terminations	Miniature circular bayonet-coupled connectors
Pneumatic connection	1/4" NPT
Approvals	
Ingress protection	IP 65 Conforms to IEC60529
Certification EMI EMC	Conforms to IEC61326-1
Standards referred	IS/IEC 60079-0:2014, IS/IEC 60079-11:2011
Vibration	Conforms to IEC60068-2-6

Pressure Transmitter	PT is external with output 4-20 mA DC one each for upstream and downstream of MeasureTrol.
-----------------------------	--

Mechanical Dimensions :

Dimension details (approx in mm) & weights (approx. in Kg) #150

SIZE	A	B	C	D	E	H	L	Weight
15NB	184	98	82	270	150	364	56	16
20NB	184	98	82	270	150	364	56	16
25NB	184	98	82	270	150	364	56	17
40NB	222	127	114	322	150	375	40	28
50NB	254	127	116	322	150	375	40	34
65NB	276	162	144	468	150	492	59	73
80NB	298	154	144	468	150	492	59	77
100NB	352	187	149	468	150	492	59	85


Fig.-1

4. Working Principle :

The **MeasureTrol** is a Pressure reducing valve that reduces upstream Steam pressure to a required downstream pressure suitable for the process applications. **MeasureTrol** with an inbuilt smart pressure controller, precisely maintains the pre-set downstream steam pressure by comparing the set point with the actual downstream pressure. The smart pressure microcontroller eliminates the error accurately using an internal PID control action & an LVDT based valve position feedback sensing technique provides fast response. This results in faster & precise downstream pressure control..

At the heart of the **MeasureTrol** is a piezo based transducer, which is a low power and low air consumption device. The electrical signal from the micro-controller is converted to precise equivalent pneumatic signals through the transducer, which operates a pilot valve. The pilot valve, in turn, supplies the proportional air to the valve actuator to accurately maintain the downstream pressure according to the setpoint.

Main Features of the MeasureTrol:

- Offers high flow turndown of 50:1
- Precise parabolic / perforated plug design provides controlled steam pressure with desired flow for process
- Operates on 24VDC power supply.
- Device communicates via a mobile app-based Bluetooth and with RS485 Modbus PC based configurator or Remote Display Unit.
- Seat design offers leakage Class IV and VI as per FCI 70.2
- Pressure reducing valve with an inbuilt smart pressure controller ensures high accuracy, compact footprint eliminating linkages used in conventional valves with positioners
- Precise pressure control with integrated indicative steam flow metering eliminates additional investment for a standalone steam flow meter
- Robust electronics design using contactless valve position feedback and downstream pressure feedback
- In-built LED indication of MeasureTrol health
- Auto/Manual PID tuning of downstream pressure
- Cloud connectivity with RTru / Bluetooth® gateway
- Parameters available for monitoring:
 - Upstream / downstream pressure
 - Indicative steam flow
 - Valve position

- Parametric trends on Remote Display Unit.
- Low air consumption of < 0.03 m³/h which ensures faster payback
- Diagnostic features available on both mobile app and optionally on PC configurator / Remote Display Unit.
- Air-to-open configuration
- configuration via Bluetooth® / PC configurator

5. Installation and Commissioning:

5.1 Lifting Arrangement

For Lifting use eye bolts provided on the top of the valve as shown in the images below.



Fig.-2

Storage:- Store the product in a dry and dust free environment in its original packing. Do not remove the protection covers on flange end connections while the product is in storage.

Note:- (To ensure valve as well user safety.) After removal from packaging keep maintaining stand attached to valve till installation on line to be done.

5.2 Mounting

5.2.1 Check materials, pressure and temperature and their maximum values. Do not exceed the limiting conditions of the valve. If the maximum operating limit of the product is lower than that of the system in which it is being fitted, ensure that a safety device is included in the system to prevent over-pressurization.

5.2.2 Remove protection covers from all connections and protective film from all name-plates, where high temperature applications.

5.2.3 Mounting orientation should be as shown below:

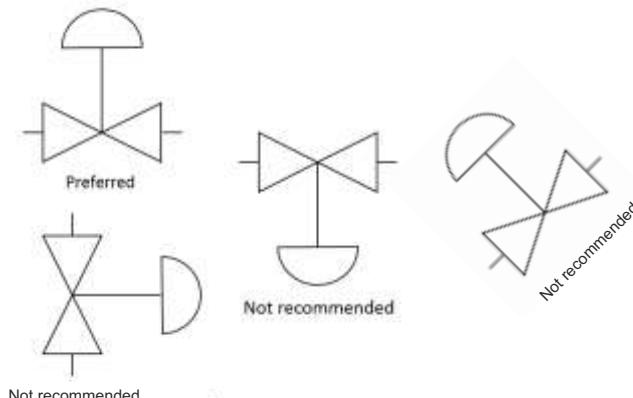


Fig.-3

5.2.4 Determine the correct installation situation and the direction of fluid flow. The valve should preferably be installed along a horizontal pipeline with the valve mounted above the pipe (see Fig 3). When mounting an actuator to the valve body, the actuator Installation and Maintenance Instructions must be followed.

5.2.5 Bypass arrangements - It is recommended that isolating valves be fitted upstream and downstream of the control valve, together with a manual bypass control valve. This enables the process to be controlled manually using the bypass valve while the pneumatic valve is isolated for maintenance (see Figure 4)

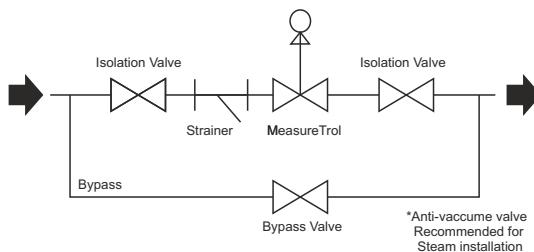


Fig.-4

5.2.6 Support pipework should be used to prevent stresses being exerted on the valve body.

5.2.7 Ensure adequate space is provided for the removal of the actuator from the valve body for maintenance purposes

5.2.8 Isolate connecting pipework. Ensure it is clean from dirt, scale etc. Any debris entering the valve may damage the head seal preventing the specified shut off.

5.2.9 Open isolation valves slowly, until normal operating conditions are achieved.
(Refer Fig.4)

5.2.10 Installation of valve and pressure transmitter.

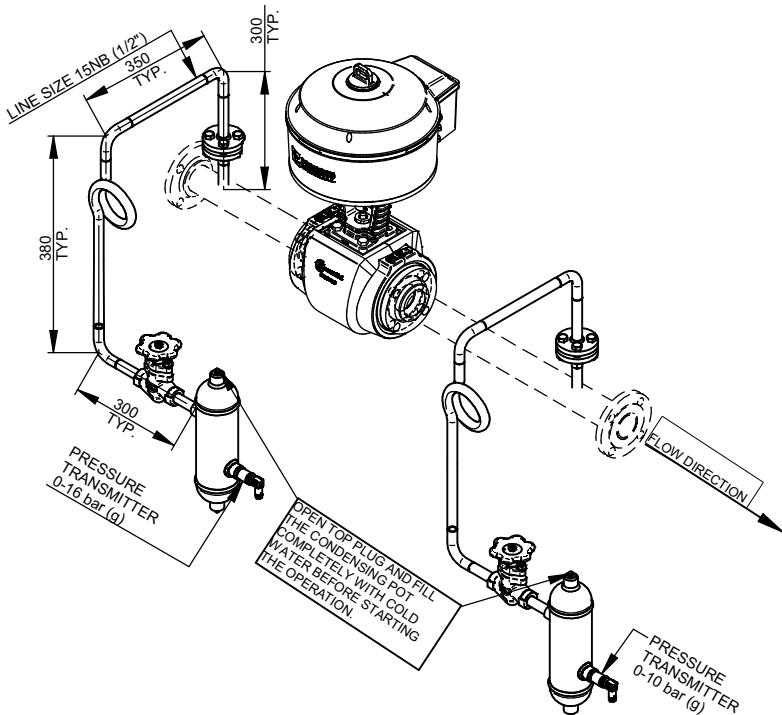


Figure - A

- 1) While installing control valve, make sure that flow arrow direction on valve body matches the flow direction.
- 2) Refer Figure - A for installing pressure transmitters along with condensing pot arrangement.
- 3) The tapping for 0-16 bar (g) pressure transmitters should be taken at a distance 300 to 500 mm upstream of control valve.
- 4) The tapping for 0-10 bar (g) pressure transmitters should be taken at a distance 500 to 750 mm downstream of control valve.
- 5) Both upstream and downstream condensing pots should be filled completely with cold water before starting the operation.

5.3 Putting Into Operation :

Electronic Module Connections and Air Connection

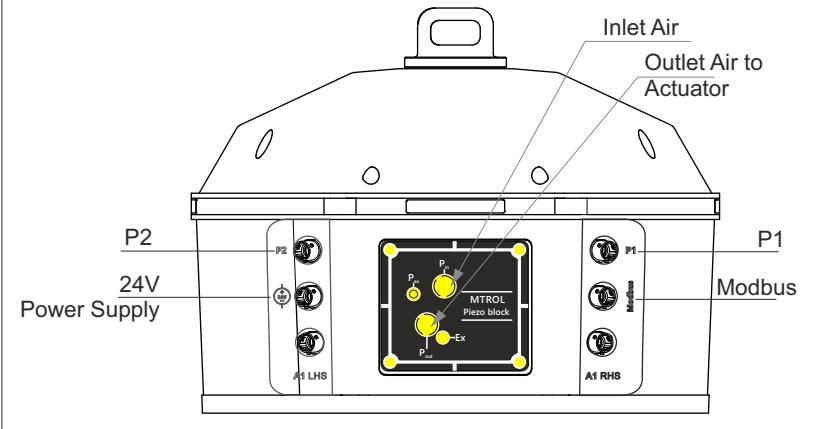


Fig.-5

For Electronic Module as well as pneumatic connections (Refer Fig. 5.)

Connect cables 24V power supply, P1, P2 and Modbus. As well as pneumatic connection.

After connecting all cables, power on the 24VDC supply to the unit follow the steps below:

- The LEDs on the unit will blink Red thrice and then green thrice followed by a steady green indication.
- Connect a mobile phone with the myFM app.(downloadable from Google Playstore) or connect a PC to the Modbus port and open the PC Configurator software / Remote Display Unit.
- Check the upstream (0 ~ 13 bar(g)) & downstream pressure(0 ~ 0.5 bar (g) approx.) instrument air pressure(1.5 ~ 7 bar (g)as per the actuator spring range) and valve position (0% approx in closed condition) on the app / PC Configurator / Remote Display Unit.

5.3.1 User Interface: Mobile Application



- MeasureTrol can be configured using mobile application. Site related details like location, Upstream pressure, Downstream pressure should be added in device settings section of mobile application.
- The MeasureTrol application displays the live Upstream (P1) and Downstream (P2) pressure on the device and comes with multiple features that include multiple units for flow, pressure, calibration date and pressure range setting.
- This application indicates an errors and warnings immediately when there is a change in pressure with respect to Downstream pressures set point, thereby helping the operator to take prompt actions.

First Power up:

Checks before power-up

Test report: For system units with reference serial number.

Note: For short supply or any damage observed inform FM or check with delivery supplier.

Powering up

- It is recommended that if required MeasureTrol unit should be opened at designated safe location.
- Once it is assembled on line and paired with MeasureTrol application, Data will be displayed.

Mobile Application

- **Initial setup :**
- MeasureTrol installed on line
- After power up and system connections, download mobile application from Play Store or Apple App Store.
- (Refer fig.6) for login and enter Username and Password.
- Username as “fm”.
- Enter password as “fm”.

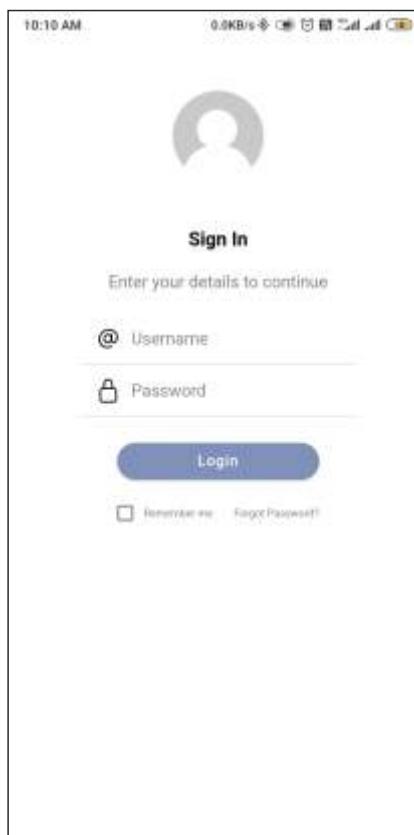


Fig.-6

- After login you will observe screen (Ref. Fig. 7) with Message as below and. Blue tooth will get connected, you will observe Forbes Marshall different Blue tooth devices in the list (Ref. Fig.8)
- Select device 'MeasureTrol'

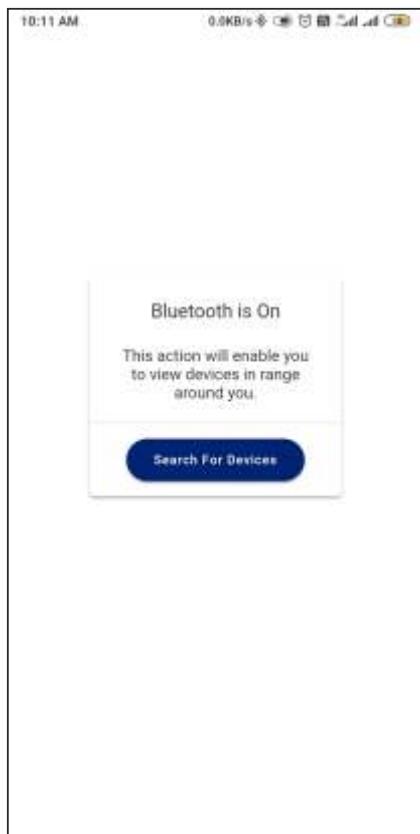


Fig.-7

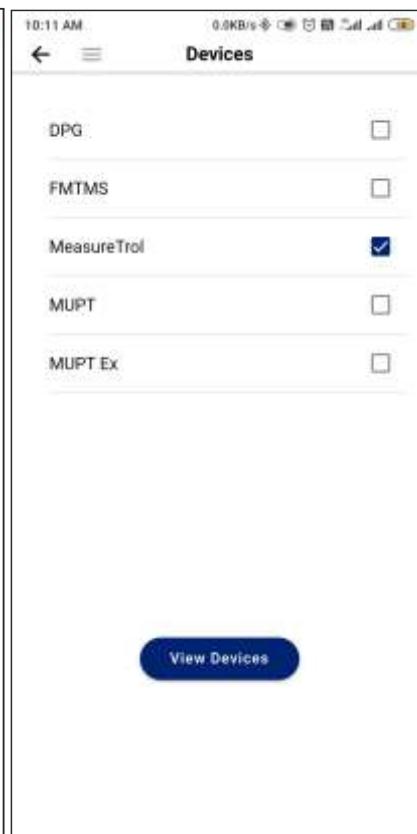


Fig.-8

- MeasureTrol Devices list will get displayed (Ref.Fig. 9)
- Select respective MeasureTrol device from the device list.
- Next screens displayed will be MeasureTrol ‘Home’ screen (Ref. Fig. 10)
- This screen will display device specific run mode values for, (P1) Upstream Pressure and unit , (P2) Downstream Pressure and unit ,(Q) Steam Flow value and unit ,(P2) Downstream Pressure set point.
- Additionally you will observe other icons like Settings, Alarm(Errors/ Warnings) & Pressure Tuning, Home and Device List etc.
- Click for understanding device specific details.



Fig.-9



Fig.-10

- Select Settings screen , there will be four options as
 - **Device Details**
 - **Configuration**
 - **Service settings**
 - **About**

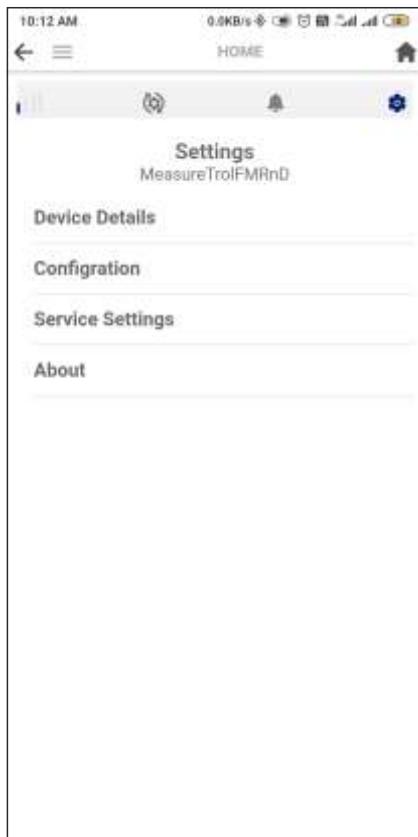


Fig.-11

- Go to the “**Device Details**”, (Ref. Fig. 12) need to be initially enter, while Installation (Allowed only to be done by FM user or FM trained person) Product Name, Serial Number, Location, Size, Make, MAC ID (will be read only), Advertise Name.
 - With help of this setting one can maintain records of the device
 - Finally select ‘SAVE’ option to update the details of the device.



Fig.-12

- Go to Settings option and select 'Configuration' (ref. Fig. 13)
- Change and set Pressure unit from options (Kg/hr, bar g)
- Add 'P1' Pressure range (min. & max.) as per pressure transmitter pressure range.
- Add 'Kv' value as written on MeasureTrol unit nameplate.
- Add 'Flow Factor' within range (0.5-1).
- If the user wants to manually enter PID values enable the PID value button and set PID values and time constant in the range of (0-30Sec.). Otherwise PID values normally will be disabled and the device will take PID values and time constant after pressure auto tuning is completed.)
- Finally select 'SAVE' option to update the configuration updates of the device.

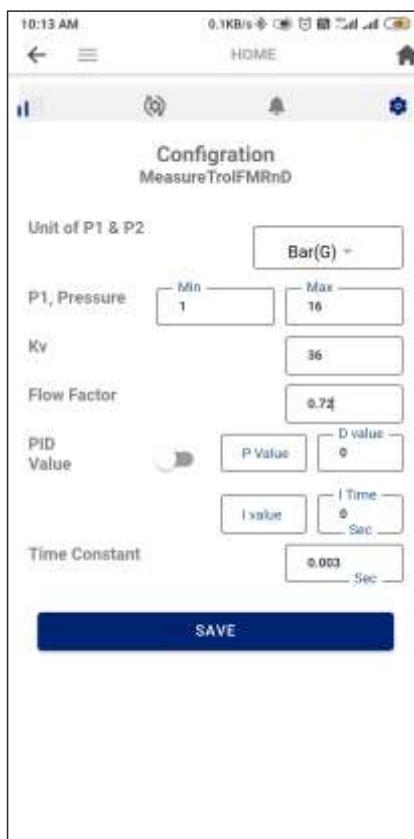


Fig.-13

Outlet Pressure Tuning:-

- Go to Home page, select symbol  to select Auto tuning
- Upstream pressure should be on during Outlet pressure auto tuning.
- For Auto Tuning page actions (Ref. Fig.14), select 'start' option for auto tuning.
- Errors/Warnings option () This option is for errors or warnings list for user ref. for diagnostics or action. These can be attended by FM trained user only or contact FM.
- Go to Home page, select symbol () (Ref. Fig. 15) for getting Error or Warnings list.

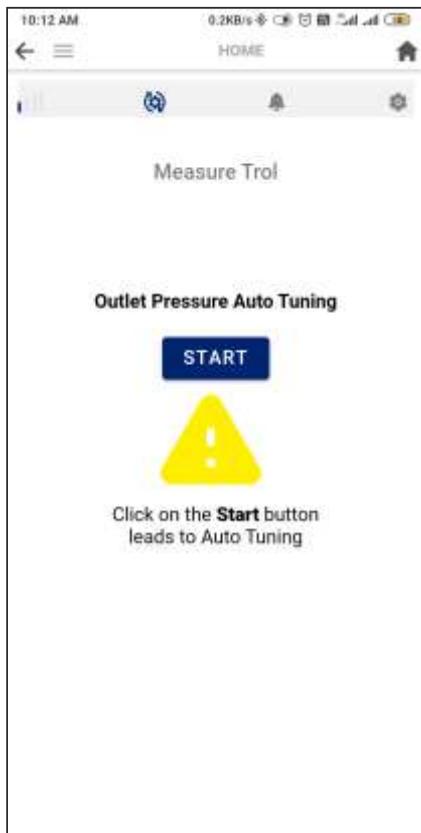


Fig.-14



Fig.-15

Position calibration and Tunning

- Go to Settings option and select 'Service Settings' (ref. Fig. 16)
- For user name & password contact FM service engineer.
- After login select Calibration /Tunning option (Ref. Fig. 17)

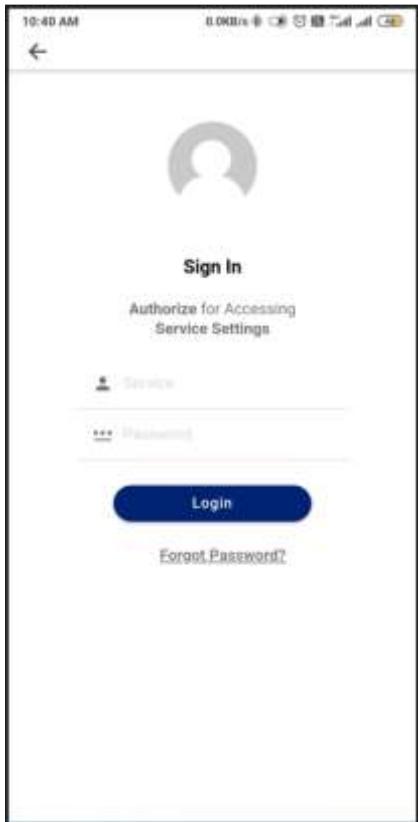


Fig.-16

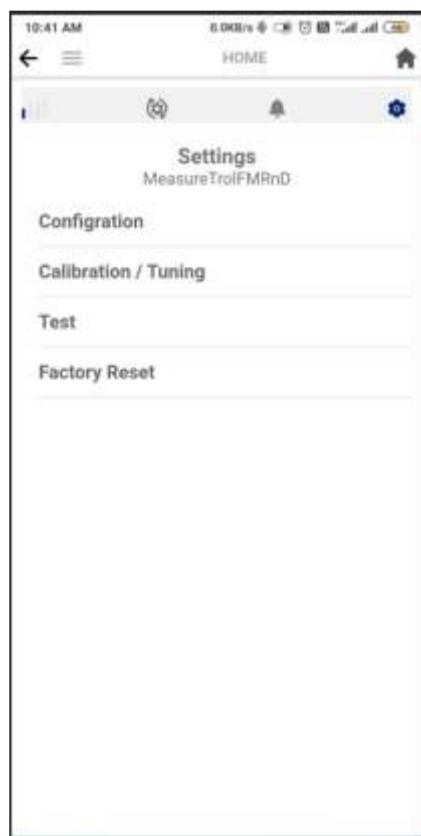


Fig.-17

Position calibration and Tunning Procedure (Ref.fig.18)

- Select 'Auto 2PT' option and then press 'Start', to complete valve calibration automatically.
- Calibration done successfully message will get displayed.
- After that 'Valve Position Tuning' button will be activated, then press 'Start' button to complete Valve position tuning.
- After completion of position calibration and tuning, select 'Enter into Run Mode' to goto run mode main screen.



Fig.-18

- Go to Settings option 'About' (ref. Fig. 19)
For Blue Tooth software and application software version details.

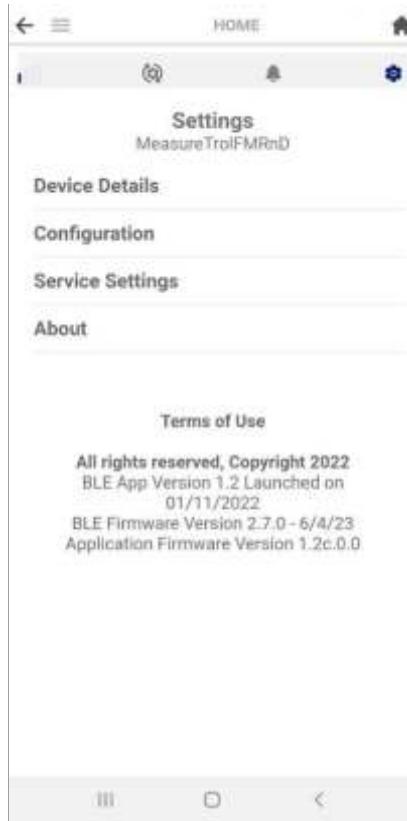


Fig.-19

5.3.2 User Interface: Remote Display Unit (Optional)



- MeasureTrol can be connected to remote display unit using MODBUS communication. application. Site related details like location, Upstream pressure, Downstream pressure should be added in device settings section of Remote Display Unit.
- The MeasureTrol application displays the live Upstream and Downstream pressure on the device and comes with multiple features that include multiple units for flow, pressure, calibration date and pressure range setting.
- This application indicates an errors and warnings immediately when there is a change in pressure with respect to Downstream pressures set point, thereby helping the operator to take prompt actions.

First Power up:

Checks before power-up

Test report: For system units with reference serial number.

Note: For short supply or any damage observed inform FM or check with delivery supplier.

Powering up

- It is recommended that if required MeasureTrol display unit should be opened at designated location.
- Once it is assembled on required line and connected with MeasureTrol data will be displayed.

MeasureTrol Display Unit:

Enclosure is Polycarbonate, IP66, with mounting options - Panel/ Wall/ Pipe (2")

LCD size: 4.3 inches (diagonal) with resolution 480 x 272 pixels

LCD Screen brightness is configurable.

There is Modbus communication between MeasureTrol unit and display, baud rate 9600 to 115200 (settable).

After connectivity between MeasureTrol unit and Display unit. Power up both the units.

- Display Unit Initial screen after Power ON (ref. Fig. 20)



Fig.-20

- Display Unit screen after Power Initialization (ref. Fig. 21)

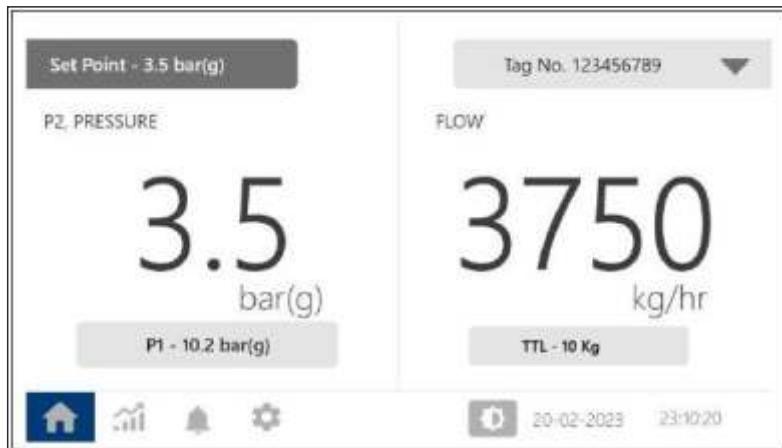


Fig.-21

- Select Settling Tab  screen 1 for Adding new device or Deleting device and to update Tag Name (Ref. Fig. 22) . User can add (+), remove/ delete (-) and enter or edit device ID (0-255) for 32 MeasureTrol units max. and Tag Name (20 Characters max.). Press center arrow  to change from screen 1 to screen 2 .



Fig.-22

- Delete Slave ID screen ref. (Fig.23) - Before deleting any device, message will displayed to confirm the same from user, as shown in image. user to confirm and select Yes or No option.



Fig.-23

- Select Settling Tab  screen 2 (Ref. Fig. 24) for RTC settings add Date (Year, Month and Day) and Time (Hour, Min, Sec.) (+) or (-) to select for scrolling digit up or down as required to set the value. screen 2 to screen 1 scrolling done by center arrow ←
- This RTC Date and Time update can be done initially only while Installation and



Fig.-24

- In Home screen user will get parameter value color changed to red color from black color for alarm condition (Ref. Fig. 25).
- To set Downstream pressure, pressure set point and enter required set point as per process requirement.

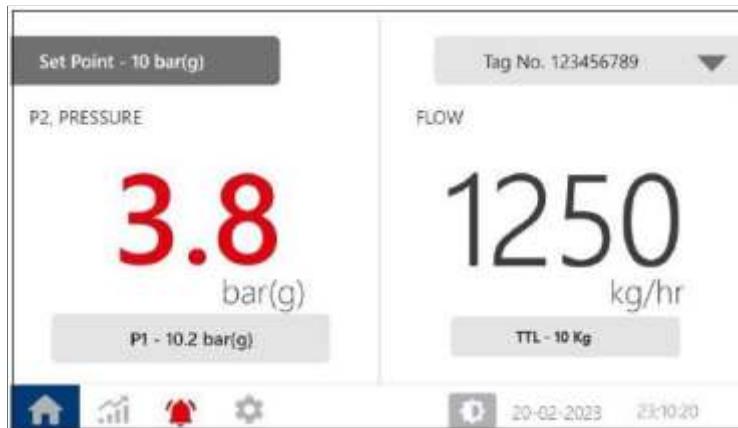


Fig.-25

- When user selects Alarm Tab () user will get Alarm dash board , where user will get all alarms and errors list with details for that specific parameter - like Tag ID, Alarm description date and time.



Fig.-26

5.3.3 MeasureTrol RS485 MODBUS PC based configurator application :



Confirm MeasureTrol RS485 Modbus cable connected to PC through RS485 to USB converter.

Power ON MeasureTrol unit and PC.

- Install MeasureTrol RS485 MODBUS PC based configurator application file on PC
- Run Application and make shortcut available on PC at specific location.
- Start Application by clicking Application shortcut.
- After software initialization, the application main screen will display (Ref. Fig.27) as below.
- Default MODBUS options (Baud Rate, Parity, Stop Bit, Address) will get displayed, change options as per settings required and select the 'Connect' button to start communication.



Fig.-27

- After communication is established the next page will get loaded (Ref.Fig. 28)



Fig.-28

- After communication is established the next page 'Process Values' will get loaded (Ref. Fig. 28)
- On this page Actual values are displayed for upstream Pressure (P1) and Downstream pressure, flow rate % opening and set point.
- Below 'Process Value' Button (Ref. Fig. 28) all other menu buttons are available as listed below,
 - Test/Process Info
 - Module Info
 - Diagnostics Info
 - Config Info
 - Calibration
 - Test Mode

- For 'Test/Process Info' Button - (Ref. Fig.29)
- On this page Test details for LVDT position feedback value, CAM Raw Values (Position, Amplitude and Frequency) and Process Units for P1,P2 and Flow Rate are displayed for user ref.



Fig.-29

- For 'Module Info' Button - (Ref. Fig.30)
 - On this page users will get read only data for Module ref. details as per user configuration.



Fig.-30

- For 'Diagnosis Info' Button - (Ref. Fig.31)
- On this page as per the configuration and actual status of the parameters, unit ref. errors and warnings list will get displayed. This information is only for ref. of user to take further Actions. Actions can be done only by FM trained person or to consult with FM customer support function.



Fig.-31

- For 'Config Info' Button - (Ref. Fig.32)
 - Config Info divided into 3 different config pages - Device, P1 & P2 - these are read and write type parameters. Last parameter setting will get displayed as read parameter and user can change parameters and write data for final data updates and saving.
 - By default Device Config page will get displayed as per (Ref. Fig.32),as per below categories, This configuration to be done/ update by FM Commissioning Engineer as per site requirements, while Installation and commissioning on site. After all the changes done on each page click 'Send' button to save data and use 'Cancel' button to cancel new entries updates.
 - Configuration Settings
 - Flow Settings
 - Valve Settings
 - Other Settings



Fig.-32

- For Upstream Pressure (P1) ref.configration (Ref. Fig.33a) and select.



Fig.-33a

- For Downstream Pressure (P2) ref.configration (Ref. Fig.33b)



Fig.-33b

- For 'Calibration' Button - (Ref. Fig.34)
- This Calibration to be done/ update by FM Trained person only or FM Commissioning Engineer as per site requirements, while Installation and commissioning on site, After all the configuration is done.



Fig.-34

- For 'Test' Button - (Ref. Fig.35)
- This 'Test' to be done/ update by FM Trained person only or FM Commissioning Engineer as per site requirements, while Installation and commissioning on site, After all the configuration is done or to diagnostics ref. As per error or warnings.
- After any test option selection user to select 'Change to Run Mode' option to come out from Test menu and go to Run Mode..



Fig.-35

5.4 MeasureTrol Process Parameter Configuration on the app/PC Configurator:

- Open the myFM App on a cell phone
- Select settings (icon) > Configuration
- Set:
 - o Units of P1,P2 : bar(g) / psi g
 - o Pressure P1 Min / Max values
 - o Enter Kv
 - o Flow factor : Value between 0.5 ~ 1
 - o Optionally set PID values and Time Constant if required

The pressure calibration will have to be done as follows:

5.5 MeasureTrol Downstream Pressure PID Tuning PROCEDURE on the app/PC Configurator:

Configure the parameters:

- On the Home screen press settings icon
- Press settings icon for downstream pressure setpoint
- Select downstream pressure autotuning
- Press 'Start' to start autotuning
- Autotuning in progress' is displayed
- On completion, 'Done Outlet Pressure Autotuning' is displayed.

5.7 Modbus Map :

Modbus Address	Register type	No of registers	Data Type	Read / Write	Parameter	Enumerated parameters
30001	Input register	2	Float	Read	LVDT position f/b	
30003	Input register	2	Float	Read	P1 (4-20mA format)	
30005	Input register	2	Float	Read	P2 (4-20mA format)	
30007	Input register	2	Float	Read	T2 (4-20mA format)	
30009	Input register	2	Float	Read	PD1	
30011	Input register	2	Float	Read	PD2	
30013	Input register	2	Float	Read	RESERVE	
30015	Input register	2	Float	Read	RESERVE	
30017	Input register	2	Float	Read	RESERVE	
30019	Input register	2	Float	Read	RESERVE	
30021	Input register	2	Float	Read	RESERVE	
30023	Input register	1	INT	Read	CAM Raw Position	
30024	Input register	1	UINT	Read	CAM Raw Amplitude	
30025	Input register	1	INT	Read	CAM Raw Frequency	
30026	Input register	1	UINT	Read	RESERVE (ADC counts for PD1)	
30027	Input register	1	UINT	Read	RESERVE (ADC counts for PD2)	
31101	Input register	2	Float	Read	Flow rate	
31103	Input register	2	Float	Read	% Opening	
31105	Input register	2	Float	Read	Displacement in mm	
31107	Input register	2	Float	Read	P2 / T2	
31109	Input register	2	Float	Read	P1	
31119	Input register	1	UINT	Read	Unit of P2 or T2	1 - bar(G) or °C 2 - PSI(G) or °F
31120	Input register	1	UINT	Read	Unit of P1	1 - Bar(G) 2 - PSI(G)
31121	Input register	1	UINT	Read	Unit of Flow Rate	1 - kg/h 2 - TPH

5.8 Putting Into Operation :

Modbus Address	Bit No.															
31201	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit 0 : LVDT circuit failure

Bit 1 : LVDT sensor out of range

Bit 2 : LVDT ultra low amplitude

Bit 3 : Inlet air failure

Bit 4 : Outlet air failure

Bit 5 : Pilot valve failure

Bit 6 : Pilot valve driver circuit failure

Bit 7 : P1 Pressure transmitter failure

Bit 8 : P2 Pressure transmitter failure

Bit 9 : EEPROM failure

Bit 10 : P1 out of range (LOW)

Bit 11 : Actuator air leakage/ insufficient actuator air pressure

Bit 12 : PD2 sensor failure

5.9 Warnings :

Modbus Address	Bit No.															
31203	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit 0 : inlet air pressure low

Bit 1 : Seat wear and tear

5.10 Maintenance schedule

5.10.1 Regular checks:

- Drain the condensate accumulated in the condensate separator of the compressed-air pressure-regulator assembly.
- Inspect the compressed air quality after any maintenance activity on the compressor/line and ensure it is oil and moisture free; see specifications on the sticker.
- Check for leakages in the inlet and outlet pneumatic tubing and joints.

5.10.2 Yearly checks / replacements :

- Replace sintered bush exhaust.
- Check and replace set of pilot valve seal every once in a year
- Check mesh filters at input and output, clean and reinstall
- Recalibrate the MeasureTrol

6. Trouble shooting:

Before operating the Positioner perform the pre-power-up checks, maintenance checks and follow all Warnings and Notes.

Listed here are some common observations with possible causes & steps to take corrective actions to help rectify problem.

NOTE

Please read the contents of this table in conjunction with the following Chapters/Sections

- Specifications
- Software Features/ Menu
- Electrical connections
- Installation/ Mechanical installation

6.1 Trouble shooting Chart:

Sr.No.	Observation/ Symptom	Cause	Corrective Action
1	Valve is not Turning 'ON'	Compliance voltage is less than specified	Check & provide Compliance voltage as recommended (Vmin~24VDC) & confirm.
		24V Power supply not connected properly or wires are open	Check & connect 24V Power supply wires with correct polarity then confirm.
		24V Power supply wires (+/-) polarity reversed.	Correct polarity & confirm.
		High water & oil content in Supply Air	Instrument supply air should be free from dust, water/ moisture & oil conforming to the specifications of air quality as per ISO 8573-1: Class 3 or ISA S7.0.01, Oil Class: 3(< 1ppm) and Humidity: Class 1. Provide specified quality Supply Air & confirm.
		Upstream Pressure Transmitter Short Circuit	Replace Pressure Transmitter
		Downstream Pressure Transmitter Short Circuit	Replace Pressure Transmitter
2	Valve does not respond to Control Input signal (set point)	High water & oil content and dust in Supply Air	Instrument Supply Air should be free from Dust, Water/ moisture & Oil conforming to the specifications of air quality as per ISO 8573-1: Class 3 or ISA S7.0.01, Oil Class: 3(< 1ppm) and Humidity: Class 1. Provide specified quality supply air & confirm.
		Input Supply Air pressure is not available or less than specified on Actuator Nameplate.	Provide Supply Air Pressure as recommended on Actuator Nameplate & confirm.
		Pressure Transmitter not working	Replace pressure transmitter
		LVDT Sensor out of range or	Maintain LVDT amplitude above 1000

Sr.No.	Observation/ Symptom	Cause	Corrective Action
3	Valve does not achieve full lift during normal operation	Insufficient Supply Air Pressure	1] Provide Supply Air Pressure as recommended on Actuator Nameplate & confirm. 2] If problem persists, check for Valve / Actuator problems as mentioned in Valve User Manual.
		Position Calibration not done properly.	Re-perform Manual 3 Point calibration as described in the Manual.
		Pressure Tuning not done properly	Re-perform pressure tuning.
		Leakage in Pneumatic circuit.	Perform Soap-Bubble test and seal the leak.
		Valve stem friction is too high	Check stem alignment & corrosion to valve stem.
4	Valve movement too Slow/Fast	Insufficient Supply Air Pressure	1] Provide Supply Air Pressure 1bar in excess of that recommended on Actuator Nameplate& confirm. 2] If problem persists, check for Valve / Actuator problems as mentioned in Valve User Manual.
		Control parameters are not tuned correctly.	Re-perform valve position calibration & tuning
		Valve stem friction too high	Check stem alignment & corrosion to valve stem
6	Position Calibration & Pressure Tuning not completed		Confirm settings & correct if required. Low inlet pressure/high friction of valve stem/ heavy leakage in actuator diaphragm/bush/. Rectify and then perform calibration.
		Input Air pressure not as required by the valve actuator as per Valve Data sheet/ Actuator Nameplate.	1] Instrument Supply Air should be free from Dust, Moisture & Oil as specified. Provide specified quality Supply Air & confirm. 2] Confirm & provide Supply Air Pressure as recommended on Actuator Nameplate & confirm.
7	Spindle hovering around the set point / loss of linearity	High friction and / or jerky movement / sticky valve stem	Rectify cause.

Sr.No.	Observation/ Symptom	Cause	Corrective Action
7	Spindle hovering around the set point / loss of linearity	Input Air pressure not as required by the valve actuator as per Valve Data sheet/ Actuator Nameplate.	1] Instrument Supply Air should be free from Dust, Water/ moisture & Oil conforming to the specifications of air quality as per ISO 8573-1: Class 3 or ISA S7.0.01, Oil Class: 3(<1ppm) and Humidity: Class 1. Provide specified quality Supply Air & confirm. 2] Confirm & provide Supply Air Pressure as recommended on Actuator Nameplate & confirm.
		Leakage in Pneumatic circuit.	Perform Soap-Bubble test and seal the leak.
8	Leakage observed even when the valve is closed.	Particle between plug & seat or high friction	Open valve check plug and seat seating area if damaged replace plug and seat
		Calibration not done properly.	Re-perform Auto 2 Point calibration & confirm.
			If problems persist in spite of taking suggested corrective actions, call FORBES MARSHALL SERVICE CENTER.

7. Maintenance Guidelines:

Note: Before initiating any installation, observe the 'Safety information' in Section 2.

If the application permits, it is recommended that a thin layer of a PTFE based grease is applied to any mating parts before reassembly.

General:

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of the service conditions. This section provides instructions on replacement packing, stem, plug and seat. All maintenance operations can be performed with the valve body in the line.

Annually:

The valve should be inspected for wear and tear replacing any worn or damaged parts such as valve plug and stem, valve seat and gland seals, refer to Section 8 'Spare parts'.

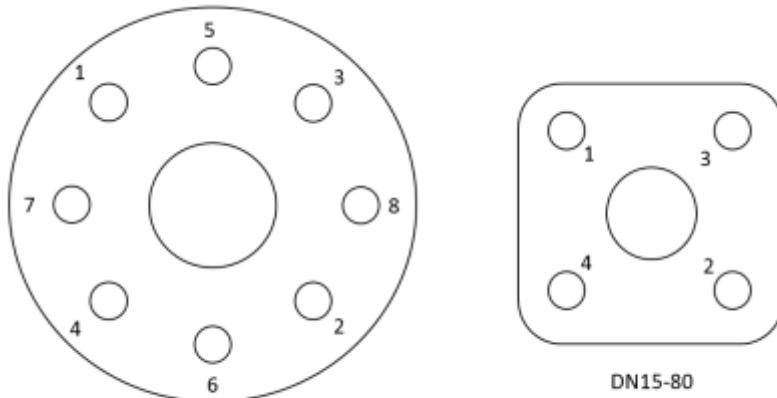
Recommended tightening torques for Body

Bonnet Joint Hex Bolts (Reference Figure 3)

Table 3 –Size wise tightening torques

MTROL Size	Torque (Nm) for #150
DN15 - DN25	70
DN40 - DN50	90
DN65 - DN80	110
DN100	110

7.1 Bonnet tightening Sequence for bonnet bolt tightening :



Note- Number indicates the sequence of tightening

Fig.-36

Note- Gland nut tightening torque 20 Nm

7.2 Removal of valve bonnet

(Reference Figure 36 & 37)

Note: This procedure is necessary before carrying out any of the maintenance procedures detailed below:

- Ensure that the valve is depressurized and clear of media Isolate it both upstream and downstream.
- **Caution:** Care should be taken when disassembling the valve in case of residual pressure being trapped between the isolation points.
- First depressurize the actuator and then disengage actuator stem from valve stem by removal of Allen bolts of coupling.
- Then apply air pressure to actuator, dismantle coupling halves
- Undo and remove the bonnet bolts (19).
- Remove the bonnet (2) and plug and stem assembly (5).
- Remove and discard the body gasket (9).

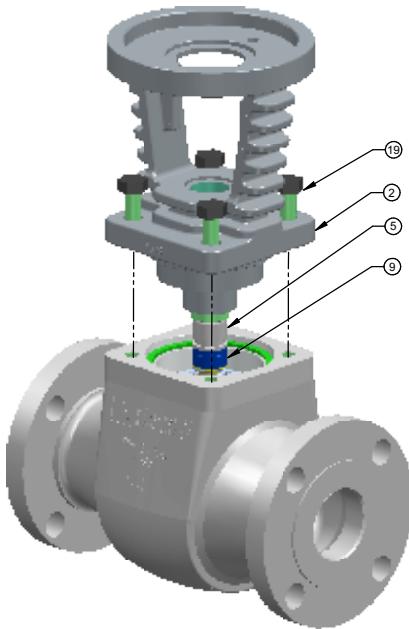


Fig.-37

7.3 Removal and replacement of PTFE gland packings

(Reference Figure 37 & 38)

- For removal of valve bonnet refer section 7.2.
- Take plug and stem assembly out from bonnet bore.
- Remove the gland nut (6) from bonnet bore. Remove Scrapper ring (9) and sliding bearing (10) from gland nut. Remove 'O' rings (13 and 14) from the gland bush, ensuring that the grooves are clean and undamaged, and replace with new Items. The use of silicone grease on the 'O' rings is recommended..
- Withdraw the gland components and discard (13, 14 15, 16).
- Clean the gland cavity bore and fit new gland components in the order as shown. When fitting the chevron seals they should be inserted with downward V orientation as indicated in fig. 38, one at a time to ease the assembly process.
- Prior and after insertion of spring (16) in the bore put washers (18)
- Apply a thin layer of anti-seize lubricant to the gland nut threads before screwing it in two or three turns. At this stage the packing must not be significantly compressed.

Valve View

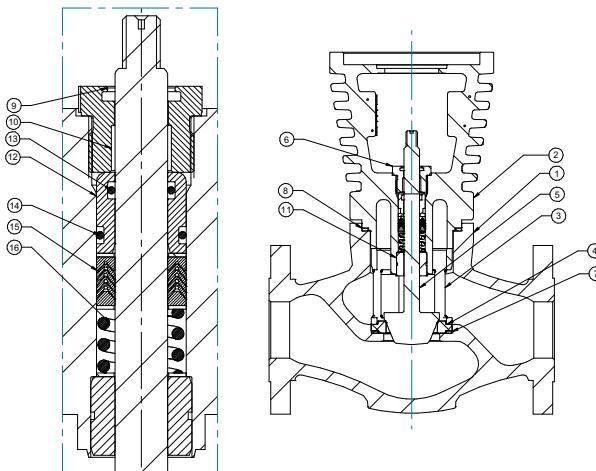


Fig.-38

Sr. No.	Part Name	Material
1	Body	ASTM A395
2	Bonnet (Top)	ASTM A216 Gr. WCB
3	Cage	BS3146(ANC-2)
4	Seat	ASTM A276 TYPE431
5	Spindle with Plug	ASTM A276 SS431
6	Gland nut	ASTM A2476 Gr.431
7	Seat Gasket	GRAPHITE
8	Top Gasket	GRAPHITE
9	Scraper Ring	virgin PTFE
10	Slider Bearing	MUP
11	Guide Bush	ASTM A276 TYPE 410
12	Gland Bush	PTFE
13	Top o-ring	VITON A VIRGIN
14	O ring	PTFE
15	V ring packing	PTFE
16	Packing spring	ASTM TYPE 302

7.5 Removal and refitting of the valve plug /stem assembly and seat :

(Reference Figure 38 & 39)

- For removal of valve bonnet refer section 7.2.
- For replacement of gland packing refer section 7.3
- Take plug and stem assembly out from bonnet bore.
- Remove the bolts from bonnet by applying specified torque; take out body top gasket from groove and discard
- Lift out the seat retaining cage (3) followed by the seat (4).
- Remove the seat gasket (7) and discard.
- Clean all components, including the seat recess in the valve body.
- Examine the seat and plug / stem assembly for damage or deterioration and renew as necessary.
- While putting seat at the recess ensure that stepped part having serrations should go downward

Note: Score marks or scaly deposits on the valve stem will lead to early failure of the gland seals and damage to seat and plug sealing faces will result in leakage rates higher than those specified for the valve.

- Fit a new seat gasket (7) in the body seat recess followed by the seat (4).
- Ensure that gasket touching surfaces should be serrated.
- Refit the cage (3) ensuring that the low thickness edge is lower most and that it sits squarely on the seat without impinging on the valve body.

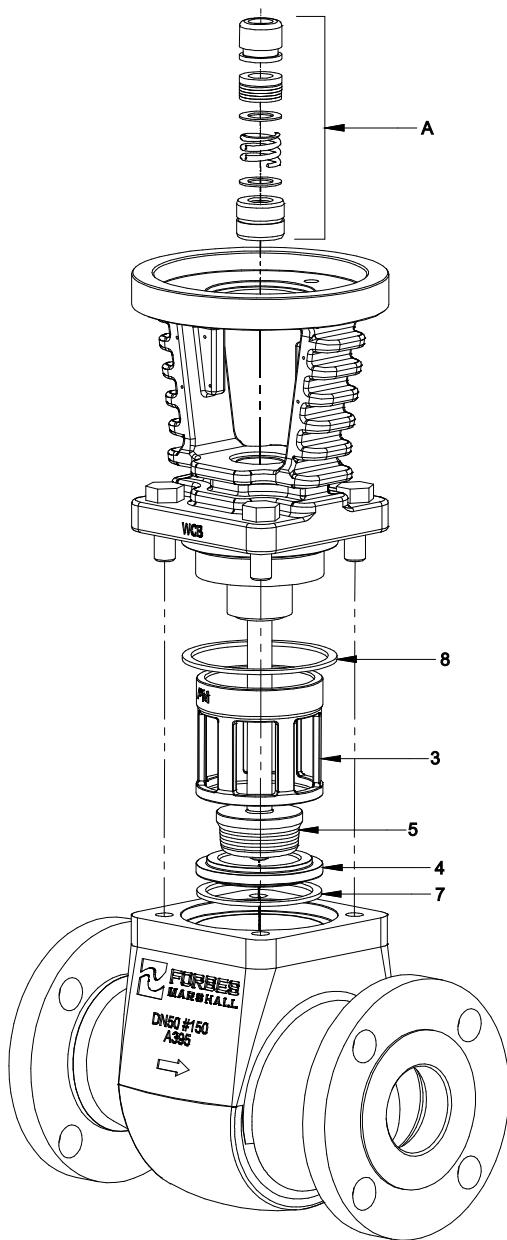


Fig.-39

7.6 Maintenance of Actuator Assembly:

The FM pneumatic actuators (and variants) are maintenance free. To ensure satisfactory operation it is strongly recommended that the control signal air is filtered and supplied dry and free of oil. Should it be necessary to replace spare parts the following procedure should be used.

CAUTION! The diaphragm housing contains powerful springs under compression. Exercise great care when dismantling. Read this Maintenance section thoroughly prior to commencing any work.

7.6.1 Removing the actuator from the valve: (Refer Fig. 40 &41)

- Drive the actuator into approximately 25% open travel position with the air supply.
- Loosen and remove the Allen screws and remove the valve coupling
- Reduce the air supply pressure until the housing is pressure free. Disconnect the air supply from the actuator.
- Loosen and remove bolt from Body-Bonnet Assembly. Remove the Bonnet-actuator Assembly from the body and place it on a clean surface .

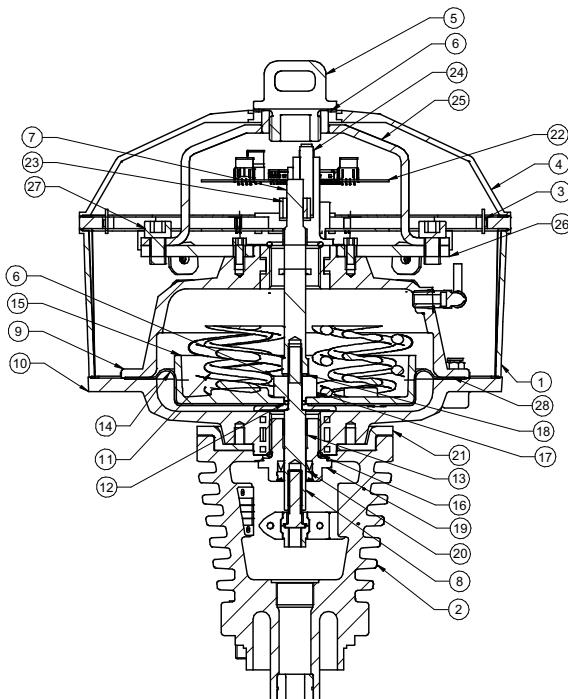


Fig.-40

Ref.Fig.-40

SR. NO	PART NAME	MATERIAL
1	Electronic Housing	PC
2	Bonnet (Top)	ASTM A216 Gr. WCB
3	LED Plate	PC
4	Top Cover	PC
5	Lifting Hook	ASTM A351 CF8
6	Lifting Hook Gasket	Nitrile
7	Upper Stem	A276 SS316
8	Lower Stem	A276 SS316
9	Upper Housing	BS 1490 LM9
10	Lower Housing	BS 1490 LM9
11	Springs	Spring Steel
12	O Ring	Nitrile
13	SlideBearing	MU
14	Diaphragm	Nitrile
15	Piston	BS 1490 LM9
16	O Ring	Nitrile
17	Stem Sleeve	A276 SS316
18	Spring Washer	A276 SS304
19	WDB Seal Holder	A276 SS304
20	Stem Seal	PU
21	Insulating Plate	PC
22	PCB Module	----
23	Target Module	----
24	LVDT Module	----
25	LiftingBracket	Carbon Steel
26	PCB Plate	Carbon Steel
27	Allen Bolt	SS304
28	Allen Bolt	SS304

7.6.2 Normally Closed Valve:

A) Diaphragm kit - How to fit: (Refer Fig. 40 & 41)

- Remove the actuator from the valve as described above section 7.6.1
- Ensure all electrical connections are removed before removing electronic housing from actuator assembly, also remove electrical connection from PCB.
- Loosen allen bolt (27) of lifting arrangement and remove lifting bracket (25), thereafter remove PCB module(22) mounted on PCB plate(26) on 3 spacers ,then remove the LVDT module(24) mounted on plate and target module(23) mounted on Spindle as shown in figure. Remove electronic housing (1) mounted with allen bolt from bottom side.

Note 1: There are 3 off longer housing Allen screws with red cap which are fitted to safely allow spring decompression. These should be removed last after all other screws are removed and should be loosened evenly to prevent distortion of the housing.

- Lubricate the threads of the three long Allen screws (28) with a PTFE based grease before releasing the tension in the springs.
- Loosen and remove the short housing Allen screws and nuts (28)
- Holding each nut with a spanner, rotate the three long Allen screws a few turns at a time. Remove the screws and upper housing (9).
- Remove the springs (11). Using a spanner to hold the actuator spindle (8), loosen the upper stem (7). Remove spring washer, Remove bush (17), 'O' ring (16), piston (15) and finally the diaphragm (14)
- Refit the new diaphragm (14) and reassemble all items in reverse order, taking care not to damage the 'O' ring. Using two spanners, while holding the actuator spindle (8) tighten the upper stem (7)
- Refit the upper housing (9) and securing the nuts and Allen screws.
- Refit PCB plate (26) on upper housing (9), and ensure LVDT module (24) and target module are facing each other and gap between them should be less than 1.5mm and then install there spacers and then mounted PCB module (22) and do all electrical connection as per connector name given on PCB.

Note: Supporting the actuator spindle (8) ensures that the diaphragm sits evenly in the lower housing. Tighten the housing screws evenly to avoid distortion. 3 off longer housing screws should be positioned 120° apart and tightened evenly prior to fitting the remaining screws To avoid distortion of the diaphragm do not fully tighten housing screws until all screws have been fitted. Final tightening should then be carried out.

Actuator Series	Screw Size	Torque (Nm)
A0	M6	30
A1	M8	40
A2	M10	50

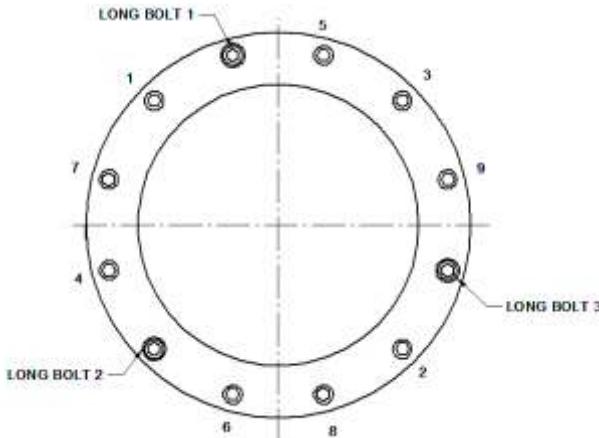


Fig.-41

B) Spring kit - How to fit (Refer Fig. 40 & 41)

- Remove the actuator from the valve as described in Section above 7.6.1 and 7.6.2
- Lubricate the threads of the three long Allen screws with a PTFE based grease before releasing the tension in the springs
- Loosen and remove the short housing Allen screws and nuts (28)
- Holding each nut with a spanner, rotate the three long Allen screws a few turns at a time. Remove the screws and upper housing (9).
- Replace with new springs. While supporting the actuator spindle (8) so that the diaphragm sits evenly in the lower housing, refit the upper housing (9) and tighten the screws evenly.

Please observe Note, above section 7.6.2

C) WDB Seal holder - How to fit (Refer Fig. 40)

- Remove the actuator from the valve as described in Section above 7.6.1 and 7.6.2
- Remove the actuator coupling & lock nut from Actuator spindle (8)
- with the help of spanner remove the WPB seal holder (9) from the lower housing (10)
- Refit the new WDB seal holder (19) dully fitted with new WDB seal (20), DU bearing (13) & O-ring (12)

7.7 Installing the Actuator:

The actuators should be installed in such a position as to allow full access to both actuator and valve for maintenance purposes. The preferred mounting position is with the actuator and valve spindle in the vertical position above or below the horizontal pipework. The air supply to the actuator must be 'dry and free from oil'. For high temperature conditions, insulate the control valve and pipework to protect the actuator.

Warning: The actuator housing must only be pressurized on the opposite side of the diaphragm holding the springs. The housing vent cap must be left unrestricted.

Fitting the actuator to a valve (Fig. 42)

- Fit the valve coupling onto the valve spindle then manually push the valve plug to its closed position. Caution: female threads must be visible inside the coupling when fitted to the valve spindle.
- Apply the control signal pressure required to bring the spindle to mid-travel position (Fig.42). Place the actuator bonnet assembly over the valve spindle and locate it onto the tighten the body-bonnet with bolt.
- Apply the minimum signal pressure + 0.1 bar maximum to the bottom of the actuator, and then adjust actuator coupling so that it touches the valve coupling.
- Release the control air signal. Fit the Allen screws as shown in Fig. 42.
- Operate the actuator and valve over its full travel four times to ensure alignment.

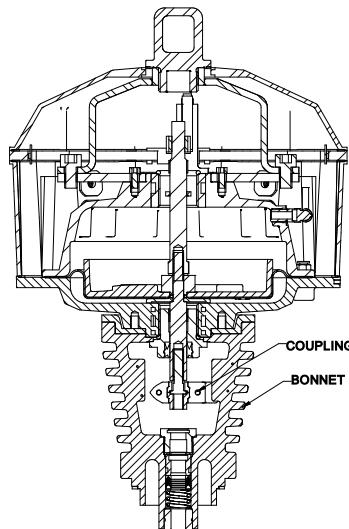


Fig.-42

Warning: To prevent damage to the valve seat, please ensure the plug does not turn while pressing on the seat during assembling or adjustment. To prevent damage to the diaphragm, ensure the actuator spindle is not allowed to rotate when the diaphragm is assembled within its housing.

8. Spare parts (Valve):

MeasureTrol DN15 to DN100 - ½" to 4"

The spare parts available are shown in solid outline. Parts drawn in broken line are not supplied as spares.

Note: When placing an order for spare parts please specify clearly the full product description as found on the label of the valve body, as this will ensure that the correct spare parts are supplied.

Table 4 Available spares (Reference Figure 39)

Gasket set		7, 8
Stem seal kits	PTFE chevrons	A
Plug stem and seat	(No gaskets supplied)	4, 5
Stem packing and gasket		A, 7, 8

How to order spares :

Always order spares by using the description given in the column headed 'Available spares', and state the FG code of the product.

Example: Plug stem and seat for MeasureTrol

050MTROL-Q1EGS41MI-M2C

How to fit spares :

Full fitting instructions are given in the Installation and Maintenance Instructions supplied with the spare.

8.1. Spare Parts (Actuator):

A0 Actuator Spare Codes		
KIT NAME	DESCRIPTION	SPARE CODE
REPAIR KIT	VALVE SPARES,MTROL, A0 ACTUATOR, SPARE TYPE : REPAIR KIT, SPARE CONSIST OF : DIAPHRAGM ASSEMBLY NC, WITHOUT HANDWHEEL, ONE SPRING & WDB SEAL HOLDER ASEMBLY [PACK OF 1]	SPARE-MTROL-A0-16NC1-RKIT
	VALVE SPARES,MTROL, A0 ACTUATOR, SPARE TYPE : REPAIR KIT, SPARE CONSIST OF : DIAPHRAGM ASSEMBLY NC, WITHOUT HANDWHEEL, TWO SPRINGS & WDB SEAL HOLDER ASEMBLY [PACK OF 1]	SPARE-MTROL-A0-16NC2-RKIT
SPRING KIT	VALVE SPARES,MTROL, A0 ACTUATOR, SPARE TYPE : SPRING KIT, SPARE CONSIST OF : EXTERNAL SPRING (1 NO) [PACK OF 1]	SPARE-MTROL-A0-16NC1-SKIT
	VALVE SPARES,MTROL, A0 ACTUATOR, SPARE TYPE : SPRING KIT, SPARE CONSIST OF : EXTERNAL SPRING (1 NO), INTERNAL SPRING (1NO) [PACK OF 1]	SPARE-MTROL-A0-16NC2-SKIT
DIAPHRAGM KIT	VALVE SPARES, MTROL, A0 ACTUATOR, SPARE TYPE : DIAPHRAGM KIT, SPARE CONSIST OF : DIAPHRAGM, STEM O RING (1	SPARE-MTROL-A0-DKIT
WDB SEAL HOLDER ASSLY KIT	VALVE SPARES, MTROL, A0 ACTUATOR, SPARE TYPE : WDB SEAL HOLDER ASSLY KIT, SPARE CONSIST OF : WDB SEAL HOLDER(NC&NO), WDB SEAL, DU BEARING & O RING (2 NOS) [PACK OF 1]	SPARE-MTROL-A0-WKIT
COUPLING SUB-ASSEMBLY KIT	VALVE SPARES, MTROL, A0-A1 ACTUATOR, SPARE TYPE : COUPLING SUB-ASSEMBLY KIT, SPARE CONSIST OF : UPPER COUPLING, LOWER COUPLING, POSITION INDICATOR FRONT, POSITION INDICATOR BACK, ACTUATOR COUPLING [PACK OF 1]	SPARE-MTROL-A0A1-CKIT
STEM KIT	VALVE SPARES,MTROL, A0 ACTUATOR, SPARE TYPE : UPPER STEM KIT, SPARE CONSIST OF UPPER STEM AND SEAL [PACK	SPARE-MTROL-A0-NC-USKIT
	VALVE SPARES,MTROL, A0 ACTUATOR, SPARE TYPE : LOWER STEM KIT, SPARE CONSIST OF LOWER STEM, CONNECTING ROD AND SEAL [PACK OF 1]	SPARE-MTROL-A0-NC-LSTKIT

KIT NAME	DESCRIPTION	SPARE CODE
SEAL KIT	VALVE SPARES,MTROL, A0 ACTUATOR, SPARE TYPE : SEAL KIT, SPARE CONSIST OF : STEM O RING (2 NOS), O RING(2 NOS), O RING, ID-29.74MM(2 NOS), WDB SEAL,	SPARE-MTROL-A0-SLKIT
HARDWARE KIT	VALVE SPARES,MTROL, A0 ACTUATOR, SPARE TYPE : HARDWARE KIT, SPARE CONSIST OF : A0 ACTUATOR ALL HARDWARE ITEMS [PACK OF 1]	SPARE-MTROL-A0-HAKIT
ELECTRONICS HOUSING SEAL KIT	VALVE SPARES,MTROL, A0 ACTUATOR, SPARE TYPE : ELECTRONICS HOUSING SEAL KIT, SPARE CONSIST OF : ELECTRONICS HOUSING GASKET(2 NOS), ACTUATOR HOUSING GASKET, PILOT VALVE	SPARE-MTROL-A0-EHSLKIT
ELECTRONICS RETROFIT KIT	VALVE SPARES, MTROL, A0-A1 ACTUATOR, SPARE TYPE : ELECTRONICS RETROFIT KIT, SPARE CONSIST OF : MAIN PCB, STANDOFF(3 NOS), M3 SCREWS(3 NOS), LED PCB, PILOT VALVE, PILOT VALVE GASKET, PRESSURE SENSOR PD1 AND PD2, O-RING(4 NOS), LVDT(25MM), LVDT HOLDER, TARGET, TARGET HOLDER, M3 SCREWS AND NUT (2NOS), INTERNAL CONNECTORS(11NOS WITH 300MM CABLE LENGTH EACH) [PACK	SPARE-MTROL-A0A1-ERFKIT
LVDT MODULE KIT	VALVE SPARES, MTROL, A0-A1 ACTUATOR, SPARE TYPE : 25MM LVDT MODULE KIT, SPARE CONSIST OF : LVDT, LVDT HOLDER, TARGET AND TARGET HOLDER, M3 SCREWS (2 NOS) AND M3 NUT(2 NOS) [PACK OF 1]	SPARE-MTROL-A0A1-LVDTKIT

A1 Actuator Spare Codes		
KIT NAME	DESCRIPTION	SPARE CODE
REPAIR KIT	VALVE SPARES,MTROL, A1 ACTUATOR, SPARE TYPE : REPAIR KIT, SPARE CONSIST OF : DIAPHRAGM ASSEMBLY NC, WITHOUT HANDWHEEL, THREE SPRINGS & WDB SEAL HOLDER ASEMBLY [PACK OF 1]	SPARE-MTROL-A1-20NC3-RKIT
	VALVE SPARES,MTROL, A1 ACTUATOR, SPARE TYPE : REPAIR KIT, SPARE CONSIST OF : DIAPHRAGM ASSEMBLY NC, WITHOUT HANDWHEEL, SIX SPRINGS & WDB SEAL HOLDER ASEMBLY [PACK OF 1]	SPARE-MTROL-A1-20NC6-RKIT

A1 Actuator Spare Codes		
KIT NAME	DESCRIPTION	SPARE CODE
SPRING KIT	VALVE SPARES,MTROL, A1 ACTUATOR, SPARE TYPE : SPRING KIT, SPARE CONSIST OF : EXTERNAL SPRING (3NOS) [PACK OF 1]	SPARE-MTROL-A1-20NC3-SKIT
	VALVE SPARES,MTROL, A1 ACTUATOR, SPARE TYPE : SPRING KIT, SPARE CONSIST OF : EXTERNAL SPRING (3NOS), INTERNAL SPRING (3NOS) [PACK OF 1]	SPARE-MTROL-A1-20NC6-SKIT
DIAPHRAGM KIT	VALVE SPARES, MTROL, A1 ACTUATOR, SPARE TYPE : DIAPHRAGM KIT, SPARE CONSIST OF : DIAPHRAGM, STEM O RING (1)	SPARE-MTROL-A1-DKIT
WDB SEAL HOLDER ASSLY KIT	VALVE SPARES, MTROL, A1 ACTUATOR, SPARE TYPE : WDB SEAL HOLDER ASSLY KIT, SPARE CONSIST OF : WDB SEAL HOLDER(NC&NO), WDB SEAL, DU BEARING & O RING (2 NOS) [PACK OF 1]	SPARE-MTROL-A1-WKIT
COUPLING SUB-ASSEMBLY KIT	VALVE SPARES, MTROL, A0-A1 ACTUATOR, SPARE TYPE : COUPLING SUB-ASSEMBLY KIT, SPARE CONSIST OF : UPPER COUPLING, LOWER COUPLING, POSITION INDICATOR FRONT, POSITION INDICATOR BACK, ACTUATOR COUPLING [PACK OF 1]	SPARE-MTROL-A0A1-CKIT
STEM KIT	VALVE SPARES,MTROL, A1 ACTUATOR, SPARE TYPE : UPPER STEM KIT, SPARE CONSIST OF UPPER STEM AND SEAL [PACK	SPARE-MTROL-A1-NC-USKIT
	VALVE SPARES,MTROL, A1 ACTUATOR, SPARE TYPE : LOWER STEM KIT, SPARE CONSIST OF LOWER STEM, CONNECTING ROD AND SEAL [PACK OF 1]	SPARE-MTROL-A1-NC-LSTKIT
SEAL KIT	VALVE SPARES,MTROL, A1 ACTUATOR, SPARE TYPE : SEAL KIT, SPARE CONSIST OF : STEM O RING (2 NOS), O RING(2 NOS), O RING, ID-29.74MM(2 NOS), WDB SEAL,	SPARE-MTROL-A1-SLKIT
HARDWARE KIT	VALVE SPARES,MTROL, A1 ACTUATOR, SPARE TYPE : HARDWARE KIT, SPARE CONSIST OF : A1 ACTUATOR ALL HARDWARE ITEMS [PACK OF 1]	SPARE-MTROL-A1-HAKIT
ELECTRONICS HOUSING SEAL KIT	VALVE SPARES,MTROL, A1 ACTUATOR, SPARE TYPE : ELECTRONICS HOUSING SEAL KIT, SPARE CONSIST OF : ELECTRONICS HOUSING GASKET(2 NOS), ACTUATOR HOUSING GASKET, PILOT VALVE GASKET, LIFTING HOOK GASKET [PACK OF	SPARE-MTROL-A1-EHSLKIT

KIT NAME	DESCRIPTION	SPARE CODE
ELECTRONICS RETROFIT KIT	VALVE SPARES, MTROL, A0-A1 ACTUATOR, SPARE TYPE : ELECTRONICS RETROFIT KIT, SPARE CONSIST OF : MAIN PCB, STANDOFF(3 NOS), M3 SCREWS(3 NOS), LED PCB, PILOT VALVE, PILOT VALVE GASKET, PRESSURE SENSOR PD1 AND PD2, O-RING(4 NOS), LVDT(25MM), LVDT HOLDER, TARGET, TARGET HOLDER, M3 SCREWS AND NUT (2NOS),INTERNAL CONNECTORS(11NOS) [PACK OF 1]	SPARE-MTROL-A0A1-ERFKIT
LVDT MODULE KIT	VALVE SPARES, MTROL, A0-A1 ACTUATOR, SPARE TYPE : 25MM LVDT MODULE KIT, SPARE CONSIST OF : LVDT, LVDT HOLDER, TARGET AND TARGET HOLDER, M3 SCREWS (2 NOS), M3 NUT(2 NOS) [PACK OF 1]	SPARE-MTROL-A0A1-LVDTKIT

A2 Actuator Spare Codes		
KIT NAME	DESCRIPTION	SPARE CODE
REPAIR KIT	VALVE SPARES,MTROL, A2 ACTUATOR, SPARE TYPE : REPAIR KIT, SPARE CONSIST OF : DIAPHRAGM ASSEMBLY NC, WITHOUT HANDWHEEL, SIX SPRINGS & WDB SEAL HOLDER ASEMBLY [PACK OF 1]	SPARE-MTROL-A2-30NC6-RKIT
	VALVE SPARES,MTROL, A2 ACTUATOR, SPARE TYPE : REPAIR KIT, SPARE CONSIST OF : DIAPHRAGM ASSEMBLY NC, WITHOUT HANDWHEEL, TWELVE SPRINGS & WDB SEAL HOLDER ASEMBLY [PACK OF 1]	SPARE-MTROL-A2-30NC12-RKIT
SPRING KIT	VALVE SPARES,MTROL, A2 ACTUATOR, SPARE TYPE : SPRING KIT, SPARE CONSIST OF : EXTERNAL SPRING (6NOS) [PACK OF 1]	SPARE-MTROL-A2-30NC6-SKIT
	VALVE SPARES,MTROL, A2 ACTUATOR, SPARE TYPE : SPRING KIT, SPARE CONSIST OF : EXTERNAL SPRING (6NOS), INTERNAL SPRING (12NOS) [PACK OF 1]	SPARE-MTROL-A2-16NC12-SKIT
DIAPHRAGM KIT	VALVE SPARES, MTROL, A2 ACTUATOR, SPARE TYPE : DIAPHRAGM KIT, SPARE CONSIST OF : DIAPHRAGM, STEM O RING (1)	SPARE-MTROL-A2-DKIT
WDB SEAL HOLDER ASSLY KIT	VALVE SPARES, MTROL, A2 ACTUATOR, SPARE TYPE : WDB SEAL HOLDER ASSLY KIT, SPARE CONSIST OF : WDB SEAL HOLDER(NC&NO), WDB SEAL, DU BEARING & O RING (2 NOS) [PACK OF 1]	SPARE-MTROL-A2-WKIT

A2 Actuator Spare Codes		
KIT NAME	DESCRIPTION	SPARE CODE
COUPLING SUB-ASSEMBLY KIT	VALVE SPARES, MTROL, A2 ACTUATOR, SPARE TYPE : COUPLING SUB-ASSEMBLY KIT, SPARE CONSIST OF : UPPER COUPLING, LOWER COUPLING, POSITION INDICATOR FRONT, POSITION INDICATOR BACK, ACTUATOR COUPLING [PACK OF 1]	SPARE-MTROL-A2-CKIT
STEM KIT	VALVE SPARES, MTROL, A2 ACTUATOR, SPARE TYPE : UPPER STEM KIT, SPARE CONSIST OF UPPER STEM AND SEAL [PACK OF 1]	SPARE-MTROL-A2-NC-USKIT
	VALVE SPARES, MTROL, A2 ACTUATOR, SPARE TYPE : LOWER STEM KIT, SPARE CONSIST OF LOWER STEM, CONNECTING ROD AND SEAL [PACK OF 1]	SPARE-MTROL-A2-NC-LSTKIT
SEAL KIT	VALVE SPARES, MTROL, A2 ACTUATOR, SPARE TYPE : SEAL KIT, SPARE CONSIST OF : STEM O RING (2 NOS), O RING(2 NOS), O RING, ID-29.74MM(2 NOS), WDB SEAL,	SPARE-MTROL-A2-SLKIT
HARDWARE KIT	VALVE SPARES, MTROL, A2 ACTUATOR, SPARE TYPE : HARDWARE KIT, SPARE CONSIST OF : A2 ACTUATOR ALL HARDWARE ITEMS [PACK OF 1]	SPARE-MTROL-A2-HAKIT
ELECTRONICS HOUSING SEAL KIT	VALVE SPARES, MTROL, A2 ACTUATOR, SPARE TYPE : ELECTRONICS HOUSING SEAL KIT, SPARE CONSIST OF : ELECTRONICS HOUSING GASKET(2 NOS), ACTUATOR HOUSING GASKET, PILOT VALVE GASKET, LIFTING HOOK GASKET [PACK OF 1]	SPARE-MTROL-A2-EHSLKIT
ELECTRONICS RETROFIT KIT	VALVE SPARES, MTROL, A2 ACTUATOR, SPARE TYPE : ELECTRONICS RETROFIT KIT, SPARE CONSIST OF : MAIN PCB, STANDOFF(3 NOS), M3 SCREWS(3 NOS), LED PCB, PILOT VALVE, PILOT VALVE GASKET, PRESSURE SENSOR PD1 AND PD2, O-RING(4 NOS), LVDT(50MM), LVDT HOLDER, TARGET, TARGET HOLDER, M3 SCREWS AND NUT (2NOS), INTERNAL CONNECTORS(11NOS) [PACK OF 1]	SPARE-MTROL-A2-ERFKIT
LVDT MODULE KIT	VALVE SPARES, MTROL, A2 ACTUATOR, SPARE TYPE : 50MM LVDT MODULE KIT, SPARE CONSIST OF : LVDT, LVDT HOLDER, TARGET AND TARGET HOLDER, M3 SCREWS (2NOS), M3 NUT(2 NOS) [PACK OF 1]	SPARE-MTROL-A2-LVDTKIT

Common for A0, A1, A2 Actuator Spare Codes		
KIT NAME	DESCRIPTION	SPARE CODE
MAIN PCB MODULE KIT	VALVE SPARES, MTROL, A0-A1-A2 ACTUATOR, SPARE TYPE : MAIN PCB MODULE KIT, SPARE CONSIST OF : MAIN PCB, STANDOFF(3 NOS), M3 SCREW(3 NOS)	SPARE-MTROL-MPCBLKIT
LED PCB MODULE KIT	VALVE SPARES, MTROL, A0-A1-A2 ACTUATOR, SPARE TYPE : LED PCB MODULE KIT, SPARE CONSIST OF : LED PCB'S(4NOS), LED CONNECTORS (4 NOS)	SPARE-MTROL-LPCBLKIT
PILOT VALVE MODULE KIT	VALVE SPARES, MTROL, A0-A1-A2 ACTUATOR, SPARE TYPE : PILOT VALVE MODULE KIT, SPARE CONSIST OF :PILOT VALVE, PILOT VALVE GASKET, PILOT VALVE CONNECTOR WITH 300MM WIRE [PACK OF 1]	SPARE-MTROL-PILVKIT
AIR PRESSURE SENSOR KIT	VALVE SPARES, MTROL, A0-A1-A2 ACTUATOR, SPARE TYPE : AIR PRESSURE SENSOR KIT, SPARE CONSIST OF :PRESSURE SENSOR PD1 AND PD2, O-RING(4NOS), INTERNAL CONNECTORES (FOR PD1 AND PD2, WITH 300MM CABLE	SPARE-MTROL-APSKIT
EXTERNAL CONNECTORS KIT	VALVE SPARES, MTROL, A0-A1-A2 ACTUATOR, SPARE TYPE : EXTERNAL CONNECTORS KIT, SPARE CONSIST OF :EXTERNAL CONNECTORS - POWER, MODBUS, P1 AND P2 WITH 1 MTR CABLE EACH [PACK OF 1]	SPARE-MTROL-ECONKIT
INTERNAL CONNECTORS KIT	VALVE SPARES, MTROL, A0-A1-A2 ACTUATOR, SPARE TYPE : INTERNAL CONNECTORS KIT, SPARE CONSIST OF : INTERNAL CONNECTORS FOR -POWER, MODBUS, P1, P2, PD1, PD2, PILOT VALVE AND LED(4NOS) WITH 300MM CABLE EACH	SPARE-MTROL-ICONKIT

9. Warranty Period:

As per the ordering information and agreement in the contract.

Disclaimer:

This information is strictly proprietary and legally privileged. All contents herein shall be the property of Forbes Marshall Pvt Ltd and having protection under the intellectual property rights. No part of this information or data may be distributed or disclosed in any form to any third party. Any dissemination, use, review, distribution, printing or copying is strictly prohibited, if you are not the intended recipient or user of this information.

**Forbes Marshall Pvt Ltd**

Manufacturing: B-85, Phase II Chakan Indl Area, Sawardari, Chakan
Tal. Khed, Dist, Pune 410 501. Tel: +91(0)2135 393400

Sales: Opp 106th Milestone, Bombay Pune Road, Kasarwadi,
Pune 411034 Tel.: +91 (0)20 39858555

CIN No: U28996PN1985PTC037806

Email : seg@forbesmarshall.com

www.forbesmarshall.com