

HARDWARE MANUAL

Ixx24-AF



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1 General

This manual covers the following products:

IHP24-AF
IDP24-AF with software DID-SW-001
IVC24-AF
IDC24-AF
ILB24-AF
ILC24-AF
IPC24-AF

1.1 Safety instructions

For a safe installation of a Val Controls device, the following must be observed. The module must be installed by qualified personnel who are familiar with the national and international laws, directives and standards that apply to this product as well as all instructions in this manual.

The information in this manual is subject to changes without notice.

1.2 Environment

Operating temperature¹: -30 to 80 °C

Storage temperature¹: -30 to 80 °C

¹ Depending on model. Please contact Val Controls

Relative Humidity: < 95% (No condensation)

The printed circuit boards are coated for tropical climate and harsh environments to resist airborne contamination according to G3, ISA-71.04-2013.

Ingress protection²: IP68

² Ex d enclosure only. For Ex e enclosure see certification label.

1.3 Mounting and dimension

Screw torque: 3.5 lb in

Wire diameter: AWG 12-22

All external components must have specifications that fit the desired performance and requirements of the valve/actuator system.

After installation the lid has to be closed properly to maintain the IP rating.

The O-ring is as standard treated with Molykote 55 O-ring grease. To maintain the IP rating the O-ring has to be treated every 2nd year with Molykote 55 O-ring grease or similar.

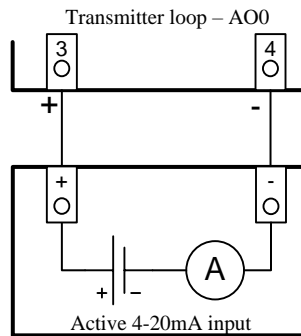
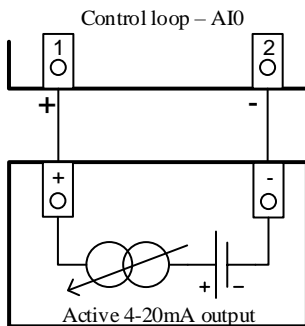
Dimensional drawing can be found on www.valcontrols.com

2 Communication

Several communication types are available as options.

2.1 Control loop – AI0 and Transmitter loop – AO0 (HART)

Passive 4-20mA input and passive 4-20mA output. On some models HART is available on either AO0 or AI0.



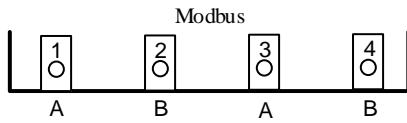
2.1.1 Terminals

AI0	1 (+) 2 (-)
AO0	3 (+) 4 (-)

2.1.2 Electrical specifications

Control loop – AI0	
Impedance	< 470 Ohm at 20mA and 9.4VDC
Linearity	< 0.1%
Temperature coefficient	0.025% / 1°C (Warm-up: 10 min)
HART (optional)	FSK, 1200Hz / 2200Hz 400-800mVpp
Galvanic isolated	
Transmitter loop – AO0	
Impedance	< 470 Ohm at 20mA and 9.4VDC
Linearity	< 0.1%
Temperature coefficient	0.015% / 1°C (Warm-up: 10 min)
HART (optional)	FSK, 1200Hz / 2200Hz 400-800mVpp
Galvanic isolated	

2.2 Modbus



2.2.1 Terminals

Modbus	
1 (A)	
2 (B)	
3 (A)	
4 (B)	

Terminals 1 and 3 are connected inside the device. Terminals 2 and 4 are connected inside the device.

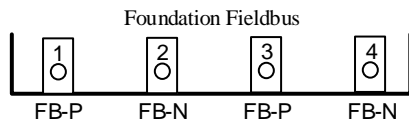
2.2.2 Electrical specifications

Modbus	
Interface	RS485
Termination resistor	No internal resistor. External resistor can be applied across terminal 3 and 4. Termination resistors must have the value of 120 Ohm.
Galvanic isolated	

A maximum of 247 nodes can be connected on the same daisy chain bus.

Typical shielding of the RS485 bus cable is done on the master side of the cable.

2.3 Foundation Fieldbus



2.3.1 Terminals

Foundation Fieldbus	1 (FB-P) 2 (FB-N) 3 (FB-P) 4 (FB-N)

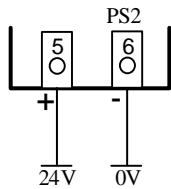
2.3.2 Electrical specifications

FF-Fieldbus	
Interface	FF-Fieldbus - H1 Device Class – Basic Device
Termination	No internal termination

3 Main board

3.1 Power supply – PS2

24VDC power input to the device.



Depending on device configuration, this power supply input may not be used.

3.1.1 Terminals

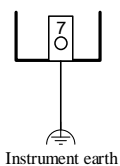
PS2	5 (+) 6 (-)
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3.1.2 Electrical specifications

Power supply – PS2	
Power supply	20.4 – 27.6VDC
Power dissipation, no position sensor/loop or valves are connected.	< 2W
Power dissipation, with maximum load on all inputs and outputs	< 5W

3.2 Earth

Device instrument earth terminal shall be connected to instrument earth bar at marshalling cabinet to avoid electromagnetic interference.

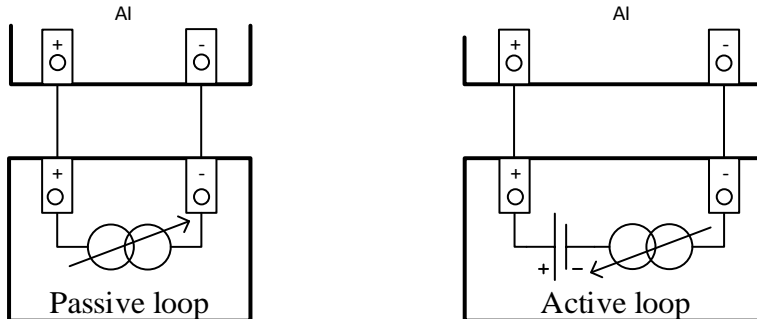


3.2.1 Terminal

IE	7 Instrument earth
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3.3 4-20mA input – AI1, AI2, AI3, AI4, AI5

The analogue inputs can be used to connect passive 4-20mA sensors to the device or in the alternative configuration active 4-20mA sensors.



3.3.1 Terminals

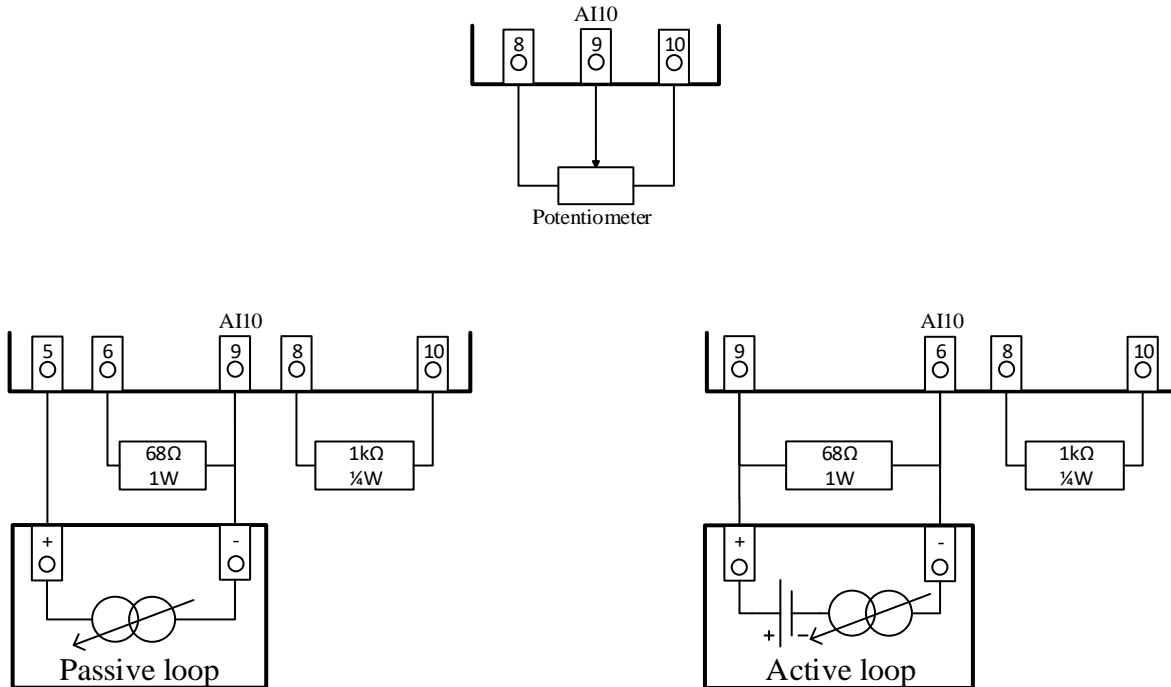
	Passive sensor	Active sensor
AI1	11 (+) 12 (-)	12 (+) 6 (-)
AI2	13 (+) 14 (-)	14 (+) 6 (-)
AI3	15 (+) 16 (-)	16 (+) 6 (-)
AI4	17 (+) 18 (-)	18 (+) 6 (-)
AI5	19 (+) 20 (-)	20 (+) 6 (-)

3.3.2 Electrical specifications

AI – Analogue inputs	
External loop max Rload	820 Ohm at 20mA and 16.4VDC
Operating area	4 – 20mA
Minimum span	12mA
Cable length	1000 meters
Linearity	< 0.1%
Temperature coefficient	0.01% / 1°C (Warm-up: 10 min)
Rin	< 100 Ohm

3.4 Position sensor – AI10

The position feedback can be delivered from a 3-wire potentiometer. The sensor input can as an alternative also be used as a 4-20mA loop input.



The external resistors must be mounted to get the correct functionality.

3.4.1 Terminals

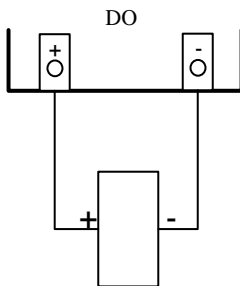
	Sensor	Passive loop	Active loop
AI10	8 Pot high 9 Wiper 10 Pot low	5 (+) 9 (-)	9 (+) 6 (-)

3.4.2 Electrical specifications

AI10 – Position sensor	
Potentiometer size	5 kΩ to 20 kΩ
Minimum use operating area	40%
Cable length	1.5 meters
Linearity	< 0.1%
Temperature coefficient	0.01% / 1°C (Warm-up: 10 min)
AI10 – Loop	
External loop max Rload	820 Ohm at 20mA and 16.4VDC
Operating area	4 – 20mA
Minimum span	12mA
Cable length	1000 meters
Linearity	< 0.1%
Temperature coefficient	0.01% / 1°C (Warm-up: 10 min)
Rin	< 100 Ohm

3.5 Digital output – DO1, DO2, DO3, DO4, DO5, DO6

24 VDC digital outputs.



3.5.1 Terminals

DO1	27 (+) 28 (-)
DO2	30 (+) 31 (-)
DO3	33: (+) 34: (-)
DO4	36: (+) 37: (-)
DO5	47: (+) 48: (-)
DO6	49: (+) 50: (-)

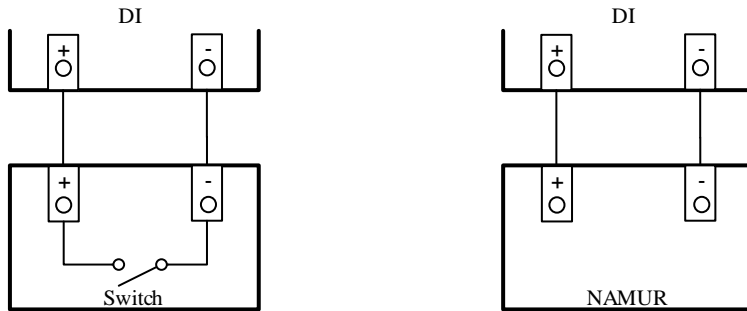
All DOs (-) are common with PS2 (-)

3.5.2 Electrical specifications

DO – Digital outputs	
Max load per digital output	up to 48W at 24VDC
Max load total	up to 192W at 24VDC

3.6 Digital input – DI1, DI2, DI3, DI4

Use digital inputs to connect dry signals.



3.6.1 Terminals

DI1	39 (+) 40 (-)
DI2	41 (+) 42 (-)
DI3	43 (+) 44 (-)
DI4	45 (+) 46 (-)

3.6.2 Electrical specifications

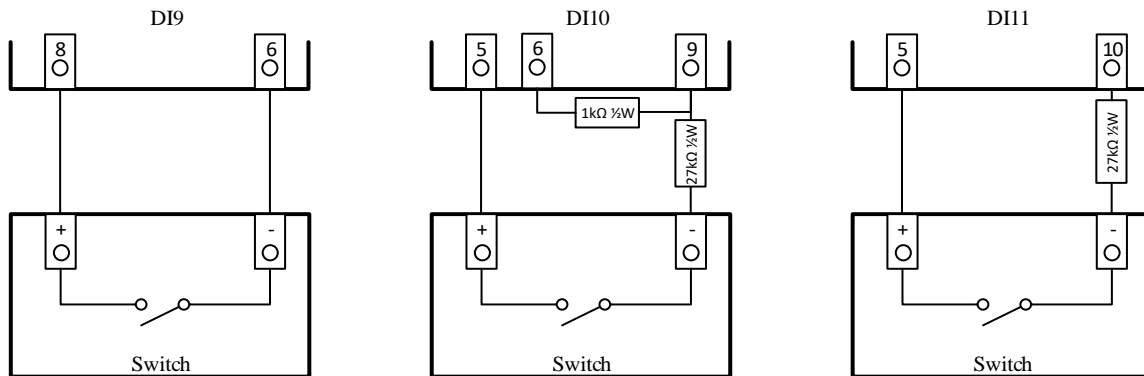
DI – Switch	
Type	Switch
Cable length	20 meters
Maximum cable resistance	100 Ohm
DI – NAMUR	
Type	NAMUR
Sensor supply voltage	8 V
Cable length	1000 meters
Max load	600 Ohm
Rin	1040 Ohm

4 Alternative digital inputs

DI9 to DI17 are analogue inputs but configured in a way that makes it possible to use them as digital inputs.

4.1 Digital input – DI9, DI10, DI11

DI9, DI10 and DI11 substitutes AI10



The external resistor must be mounted to get the correct functionality.

4.1.1 Terminals

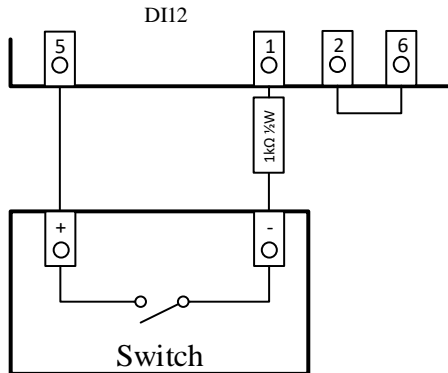
DI9	8 (+) 6 (-)
DI10	5 (+) 9 (-)
DI11	5 (+) 10 (-)

4.1.2 Electrical specifications

DI12	
Type	Switch
Cable length	1.5 meters

4.2 Digital input – DI12

DI12 substitutes AI0



The external resistor and connection between terminal 2 and 6 must be mounted to get the correct functionality.

4.2.1 Terminals

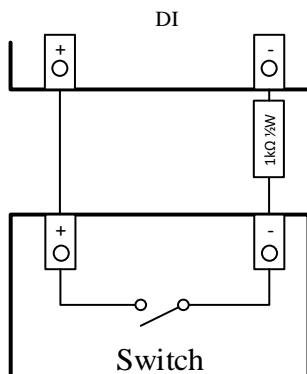
DI12	1 (+) 5 (-)
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4.2.2 Electrical specifications

DI12	
Type	Switch
Cable length	1000 meters

4.3 Digital input – DI13, DI14, DI15, DI16, DI17

DI13 substitutes AI1, DI14 substitutes AI2, and so on.



The external resistor must be mounted to get the correct functionality.

4.3.1 Terminals

DI13	11 (+) 12 (-)
DI14	13 (+) 14 (-)
DI15	15 (+) 16 (-)
DI16	17 (+) 18 (-)
DI17	19 (+) 20 (-)

4.3.2 Electrical specifications

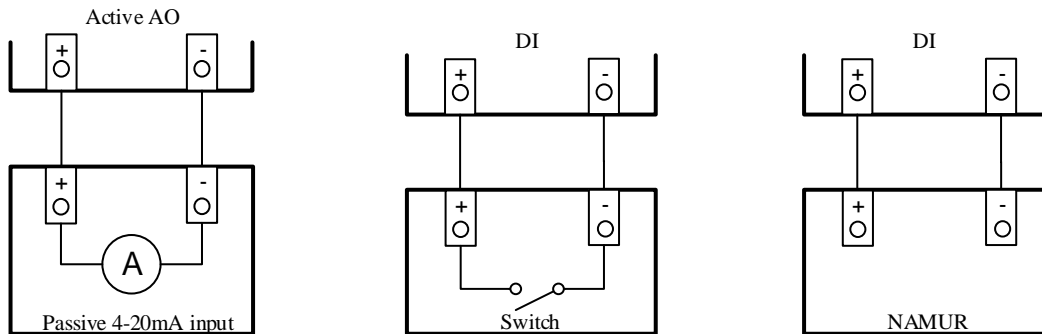
DI – Switch	
Type	Switch
Cable length	1000 meters

5 Expansion

The expansion terminals have different function depending on which expansion module is installed.

5.1 Active analogue output – AO1, AO2 and Digital inputs – DI5, DI6

Use the two analogue outputs to connect 4-20mA loop inputs e.g. proportional valves.



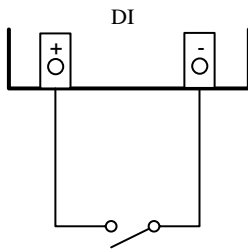
5.1.1 Terminals

AO1	21 (+) 22 (-)
AO2	23 (+) 24 (-)
DI5	51 (+) 52 (-)
DI6	25 (-) 26 (+)

5.1.2 Electrical specifications

AO1 – AO2 – Active analogue output	
Max load	550 Ohm at 20mA and 20.4VDC PS2 supply
Linearity	< 0.1%
Temperature coefficient	0.015% / 1°C (Warm-up: 10 min)
DI – Switch	
Type	Switch
Cable length	20 meters
Maximum cable resistance	100 Ohm
DI – NAMUR	
Type	NAMUR
Sensor supply voltage	8 V
Cable length	1000 meters
Max load	600 Ohm
Rin	1040 Ohm

5.2 Digital input – DI5, DI6, DI7, DI8



5.2.1 Terminals

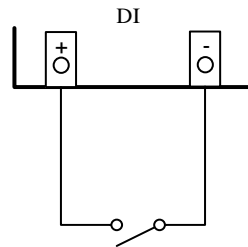
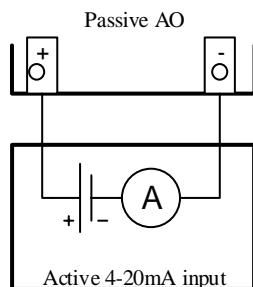
DI5	51 (+) 52 (-)
DI6	25 (-) 26 (+)
DI7	23 (+) 24 (-)
DI8	21 (+) 22 (-)

5.2.2 Electrical specifications

DI – Switch	
Type	Switch
Cable length	20 meters
Maximum cable resistance	100 Ohm
DI – NAMUR	
Type	NAMUR
Sensor supply voltage	8 V
Cable length	1000 meters
Max load	600 Ohm
Rin	1040 Ohm

5.3 Passive analogue output – AO1, AO2 and Digital inputs – DI5, DI6

The two analogue outputs can be used to connect 4-20mA.



5.3.1 Terminals

AO1	21 (+) 22 (-)
AO2	23 (+) 24 (-)
DI5	51 (+) 52 (-)
DI6	25 (-) 26 (+)

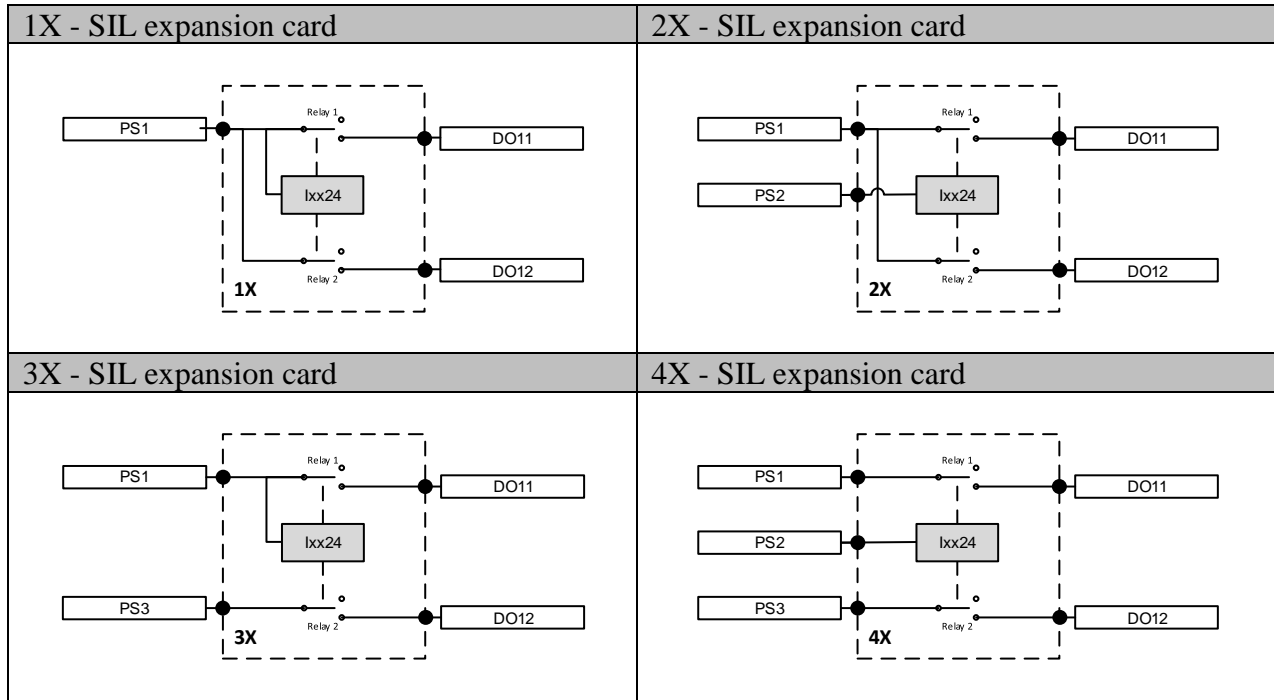
5.3.2 Electrical specifications

AO1 – AO2 – Passive analogue output	
Impedance	< 470 Ohm at 20mA and 9.4VDC
Linearity	< 0.1%
Temperature coefficient	0.015% / 1°C (Warm-up: 10 min)
DI – Switch	
Type	Switch
Cable length	20 meters
Maximum cable resistance	100 Ohm
DI – NAMUR	
Type	NAMUR
Sensor supply voltage	8 V
Cable length	1000 meters
Max load	600 Ohm
Rin	1040 Ohm

5.4 SIL – PS1, PS3, DO11, DO12

A device with an internal SIL Expansion Card can be installed in a SIL 1-4 installation without affecting the SIL level. Device can be equipped with 4 different types of SIL Expansion Cards.

The units are approved for installation in SIL 1-4 circuits, if installed as described in this manual.



X	Relay 1	Relay 2
1	Normally close	Normally open
2	Normally close	Normally close
3	Normally open	Normally open
4	Normally open	Normally close

5.4.1 Terminals

Power supply	Digital output
5. PS2 (+)	23. DO11 (+)
6. PS2 (-)	24. DO11 (-)
21. PS1 (+)	25. DO12 (+)
22. PS1 (-)	26. DO12 (-)
51. PS3 (+)	
52. PS3 (-)	

Note: The PS1, PS2 and PS3 must be galvanic isolated.

5.4.2 Electrical specifications

Power supply	20.4 – 27.6VDC
Power dissipation, no position sensor/loop or output lamps are connected.	< 2W
Power dissipation, with maximum load on all inputs and outputs	< 5W, the load not included
Max load per DO11 and DO12	up to 48W @24VDC
If PS2 is not used, total load that can be drawn from all DO/DI/AI ports (except DO11/12)	2W

5.5 Internal watch and SD card

5.5.1 Electrical specifications

Internal Watch	
Time deviation	$\Delta f/f_0 = \pm 20\text{ppm}$
Aging	$\Delta f/f_0 = \pm 3\text{ppm} / \text{Year}$
Temperature coefficient	$\beta = -0.034 \pm 0.006\text{ppm}/^\circ\text{C}^2$
Battery life (Estimated)	10 year

Please contact Val Controls for a replacement battery.

The SD card is used to store signatures. Do not move the SD card between devices. Contact Val Controls for a replacement SD card.

Disposal of this product and/or battery shall be in accordance with local environmental laws and regulations.

