

GOSH Data interchange for sensors classifications



MOTIVATION

- Infusion Pumps deliver nutrients and medications into a patient's body in controlled amounts.
- Portable Infusion Pumps are also being used to treat patients at home.
- Since infusion Pumps are used to administer critical fluids, including high-risk medications, **pump failures** can have significant implications for the patient safety.
- Sensors are key components in controlling and monitoring infusion pumps.
- They monitor fluid flow and volume, provide occlusion detection and, in some cases, the temperature of the fluid.
- Therefore, sensors must be **reliable**, **accurate**, **fast** and **compact** in size.



SENSORS

1. Force Sensor

Make sure the fluids can deliver to the patients by detecting if there any blockages.

2. Pressure Sensor

Monitors and control the pressure of peristaltic pumps

3. Magnetic Position Sensor

Monitor the velocity and orientation of motors and make sure the motor is under control

4. AML switches

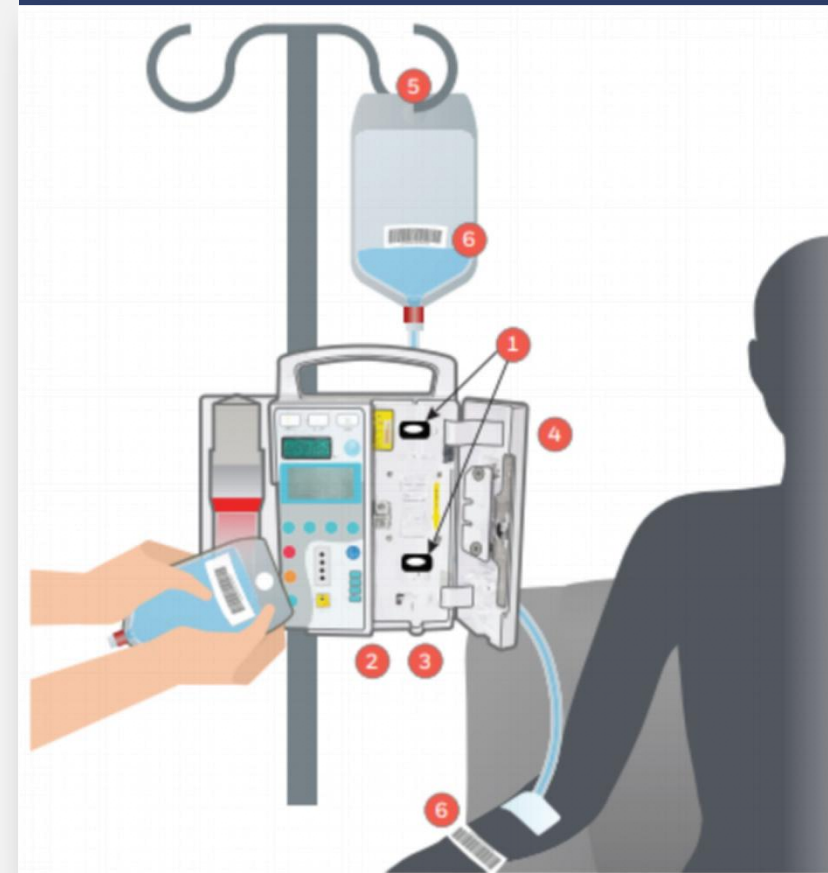
On/Off switches and to identify open panels

5. Subminiature Load Cells

Keeps track of the weight of the IV bag

6. Barcode Scan Engines

Scans barcodes on IV bags and patient wrist bands



FORCE SENSORS

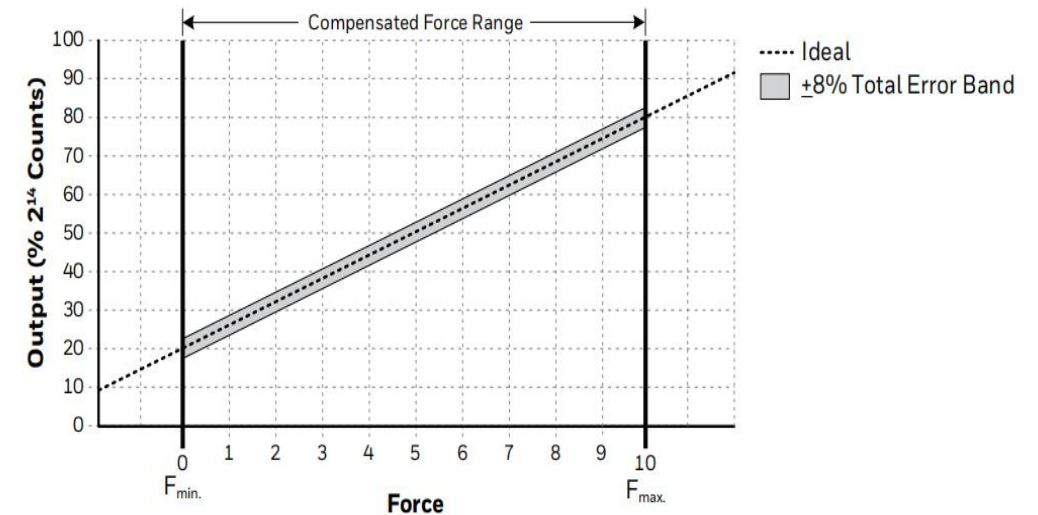
- Monitor the delivery of fluids, medicines or nutrients to the patient.
- Detect blockages and determine when the bag containing fluids or nutrients needs to be changed
- Used in a non-invasive manner and require no disinfection or sterilisation before reuse.

TABLE 1. FORCE SENSORS FEATURES

MICROFORCE FMA SERIES	TBF SERIES
<ul style="list-style-type: none"> • Amplified and temperature compensated • Small form factor: 5 mm x 5 mm [0.20 in x 0.20 in] • Digital output (I²C/SPI) simplifies new designs 	<ul style="list-style-type: none"> • Unamplified and temperature compensated • Analogue (mV) output • Liquid media compatibility
FSA, FSG, FSS SERIES	1865 SERIES
<ul style="list-style-type: none"> • Wide variety of force ranges • Analogue or digital (I²C/SPI) output • Large coupling area simplifies integration within application 	<ul style="list-style-type: none"> • Unamplified and temperature compensated • Analogue (mV) output • Liquid media compatibility

TABLE 6. SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES (DIGITAL VERSIONS ONLY)

% OUTPUT	DIGITAL COUNTS	
	DECIMAL	HEX
0	0	0x0000
10	1638	0x0666
50	8192	0x2000
90	14746	0x399A
100	16383	0x3FFF



$$\text{Output (\% of } 2^{14} \text{ counts)} = \frac{60\%}{\text{Force}_{\text{range}}} \times (\text{Force}_{\text{applied}}) + 20\%$$

PRESSURE SENSORS

- Monitor and control peristaltic pump.
- Provides high levels of accuracy, sensitivity and reliability.
- Low-power consumption.
- Analogue/Digital (I²C/SPI) output

BASIC ABP/ABP2 SERIES

- Pressure range 5 mbar to 25 bar
- Measures absolute, gage and differential
- Amplified and temperature compensated
- Analogue or digital (I²C/SPI) output
- Supports liquids and dry gases

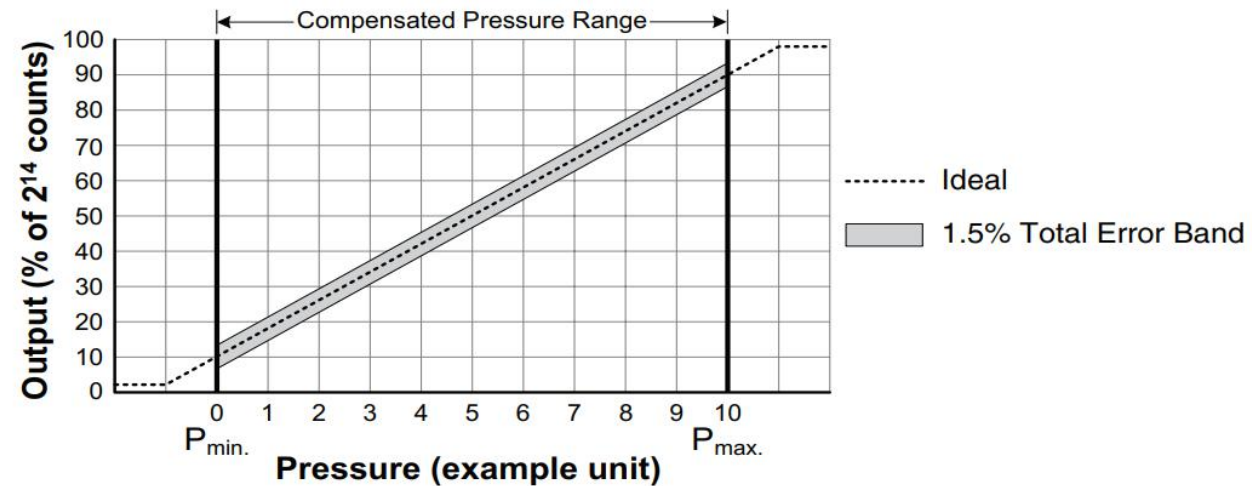
MICROPRESSURE MPR SERIES

- Pressure range 60 mbar to 2.5 bar
- Measures absolute and gage
- Amplified and temperature compensated
- Digital (I²C/SPI) output (24-bits)

TABLE 6. SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES (DIGITAL VERSIONS ONLY)

% OUTPUT	DIGITAL COUNTS	
	DECIMAL	HEX
0	0	0x0000
10	1638	0x0666
50	8192	0x2000
90	14746	0x399A
100	16383	0x3FFF

Digital Versions



$$\text{Output (\% of } 2^{14} \text{ counts)} = \frac{80\%}{P_{\text{max.}} - P_{\text{min.}}} \times (\text{Pressure}_{\text{applied}} - P_{\text{min.}}) + 10\%$$

MAGNETIC POSITION SENSOR

- Monitor placement of tube in pump cavity to ensure orientation along with pump motor speed control.
- Provide more accurate output and reduces noise and vibration with smooth motor control.
- Highly reliable, therefore reduces repair and maintenance costs.
- Consistent operation over the full temperature range.

SS490

- Quad Hall-effect design
- Unipolar, bipolar or latching
- Optimized slope compensation
- Wide temperature range

SS360/SS460

- Fast response time
- High sensitivity
- Latching magnetics

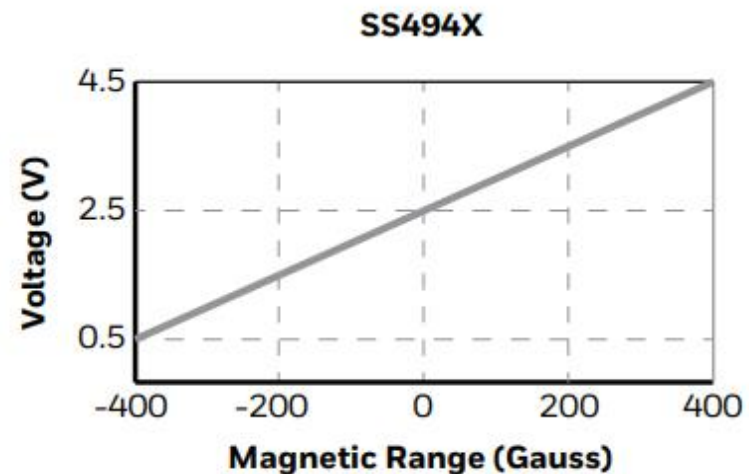
MICROPOWER SL353

- Energy efficient
- Non-chopper stabilized design
- Omnipolar sensing, activates with either magnetic pole

NANOPOWER SERIES

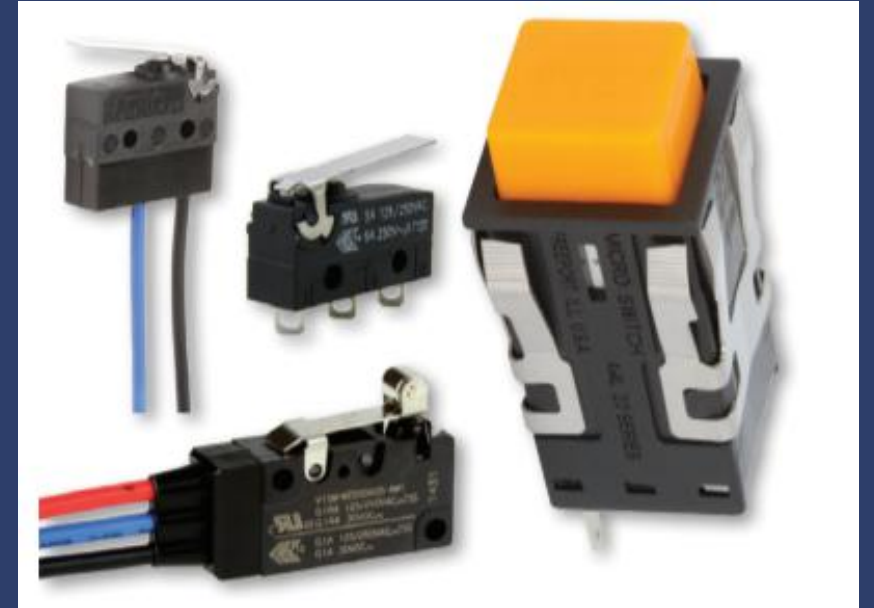
- High sensitivity
- Ultra-low power consumption
- Omnipolar sensing, activates with either magnetic pole

Figure 3. Transfer Characteristics: Typical Output Voltage



BASIC AML SWITCHES

- Switches for on/off operator controls
- Detect covers/panels
 - prevent pump from operating when its not fully closed
- Different models:
 - ZD Series – uses pin plunger as an actuator
 - ZW Series – uses lever as an actuator



SUBMINIATURE LOAD CELLS

- Determines how much fluid remains in the feeding bag by monitoring the weight.
- Model 31 High:

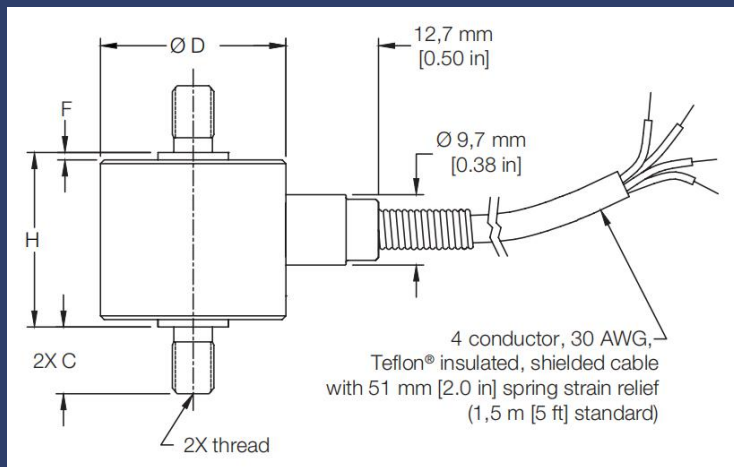


Table 1. Performance Specifications

Characteristic	Measure
Load ranges	10 kN, 20 kN, 50 kN 2000 lb, 5000 lb, 10000 lb
Linearity	± 0.2 % full scale
Hysteresis	± 0.2 % full scale
Non-repeatability	± 0.05 % full scale
Full scale output (tolerance)	2 mV/V (nominal)
Operation	Tension/compression ³
Resolution	Infinite

BARCODE SCAN ENGINES & SOFTWARE

- Read the barcode and make sure the suitable treatment is used to treat the patient
- N670X Series 2D Scan Engines:

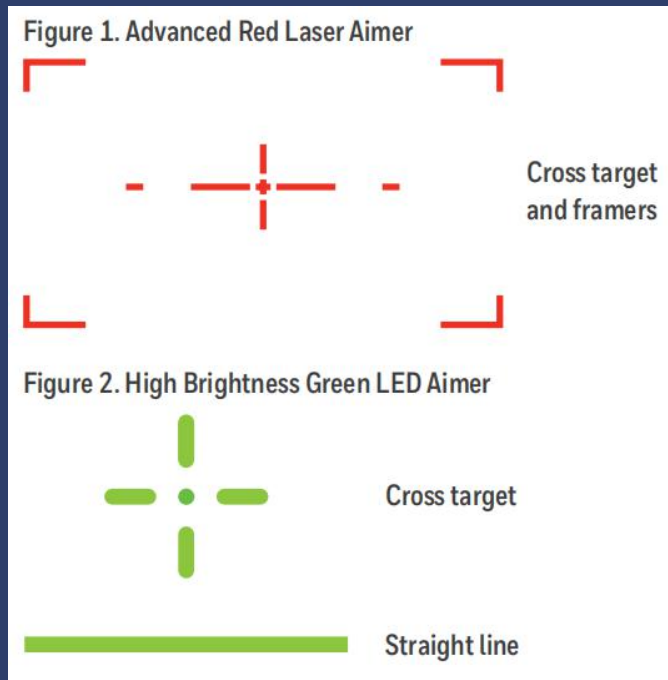


TABLE 4. PERFORMANCE	
Characteristic	Parameter
SENSOR	1280 X 800 global shutter
ILLUMINATION	white or red LED: exempt risk group
OPTICS	SR (standard range), HD (high density)
AIMING	advanced red laser: cross target and framers high brightness green LED: cross target or straight line
TYPICAL FRAME RATE	up to 60 frames/s
MOTION TOLERANCE	600 cm/s [236 in/s] maximum 400 cm/s [157 in/s] typical
FIELD OF VIEW	horizontal: 48°, vertical: 31°
SCAN ANGLES	tilt: 360°, pitch: ±60°, skew: ±60°
SYMBOL CONTRAST	20% minimum print contrast ratio
RESOLUTION	SR optics: 3 mils C39 (1D), 7 mils Data Matrix (2D), 7 mils QR (2D), 4 mils PDF 417 (2D stacked) HD optics: 2,5 mils C39 (1D), 5 mils Data Matrix, 5 mils QR (2D), 4 mils PDF417 (2D stacked)
WARRANTY	15-month limited warranty; the warranty period starts at date of shipment from Honeywell to customer

REFERENCES

- Sensors for infusion pump - <https://sensing.honeywell.com/SIOT-Solutions-Infusion-Pumps-008045-10-EN.pdf>
- Force Sensors, Basic ABP Series - <https://sensing.honeywell.com/honeywell-sensing-basic-board-mount-pressure-abp-series-datasheet-32305128-en.pdf>
- MicroForce FMA Series Force Sensors Datasheet - <https://sensing.honeywell.com/honeywell-sensing-force-fma-series-datasheet-32347833.pdf>
- Magnetic position sensors, SS490 Datasheet - <https://sensing.honeywell.com/honeywell-sensing-sensors-linear-hall-effect-ics-ss490-series-datasheet-005843-2-en.pdf>
- High Range Precision Miniature Load Cells, Model 31 High datasheet - <https://sensing.honeywell.com/honeywell-test-and-measurement-model-31-high-miniature-load-cell-product-sheet-008631-2-en.pdf>
- N670X Series 2D Scan Engines Datasheet - <https://sensing.honeywell.com/honeywell-oem-2d-imagers-n670x-series-datasheet-007613.pdf>

Thank you

