

SOLUTIONS FOR INFUSION PUMPS

Sensors and Switches

Application Note

Infusion pumps are used to deliver fluids, medicines or nutrients to patients. Fluids and medicines are delivered intravenously directly into the blood stream and nutrients are delivered directly into the stomach.

BACKGROUND

Infusion pumps are medical devices that deliver fluids, such as nutrients and medications, into a patient's body in controlled amounts. They are commonly used in hospital intensive care units and wards, but smaller portable infusion pumps are now being used to treat patients at home.

These devices offer significant advantages over manual administration of fluids, including the ability to deliver fluids in very small volumes, and the ability to deliver fluids at precisely programmed rates or automated intervals.

There are many types of infusion pumps, including large volume, patient-controlled analgesia (PCA), syringe, enteral and insulin pumps. Some are designed mainly for stationary use at a patient's bedside. Others, called ambulatory infusion pumps, are designed to be portable or wearable.

SOLUTIONS

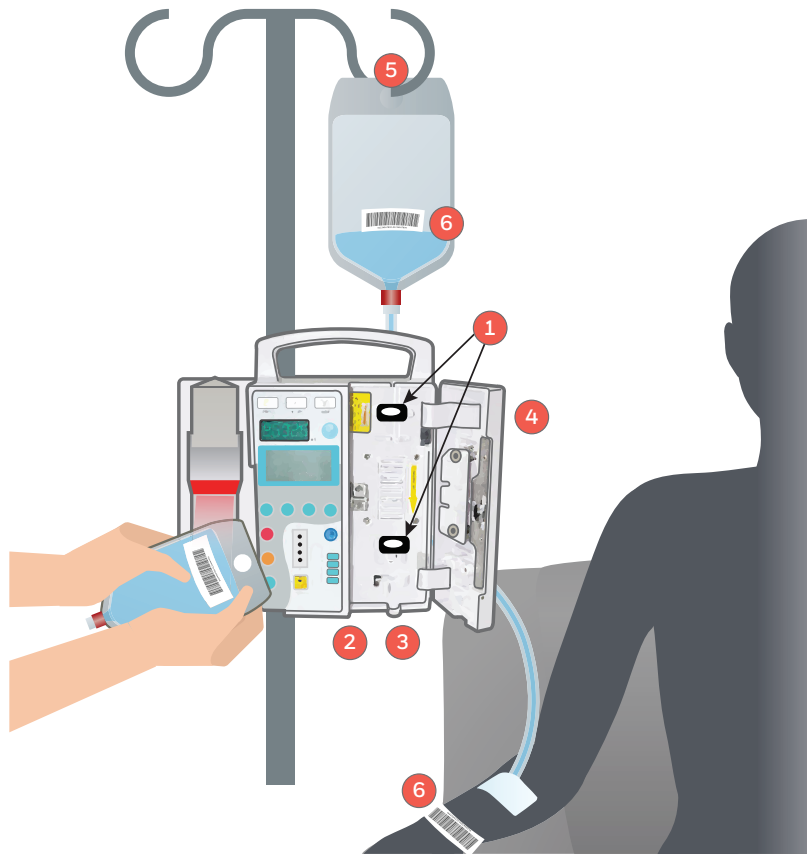
Honeywell sensor and switch solutions are designed to enhance the performance and reliability of infusion pumps, monitor the delivery of fluids, medicines and nutrients to the patient and ensure the safe administration of the treatment to the patient (See Figure 1).

SOLUTIONS FOR INFUSION PUMP APPLICATIONS

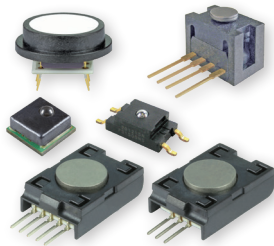
- Force Sensors
- Pressure Sensors – Board Mount
- Magnetic Position Sensor ICs
- Basic and AML Switches
- Subminiature Load Cells
- Barcode Scan Engines & Software

Honeywell

Figure 1. Solutions for Infusion Pump Applications



- 1 Force Sensors**
MicroForce FMA Series; FSA Series, FSG Series, FSS Series, TBF Series, 1865 Series
- 2 Pressure Sensors - Board Mount**
Basic ABP Series; MicroPressure MPR Series (peristaltic pump applications)
- 3 Magnetic Position Sensor ICs**
Hall-Effect: SS490 Series; SS360NT, SS360ST, SS460S; Micropower SL353 Series or Magnetoresistive: Nanopower Series
- 4 Basic and AML Switches**
V15W, ZD and ZW Series Sealed Basics; AML Series (Pushbutton and Rocker)
- 5 Subminiature Load Cells**
Models 31 and 11
- 6 Barcode Scan Engines & Software**
N670X & N660X Series; SwiftDecoder™



FORCE SENSORS

MicroForce FMA Series; FSA, FSG, FSS Series; TBF Series; 1865 Series

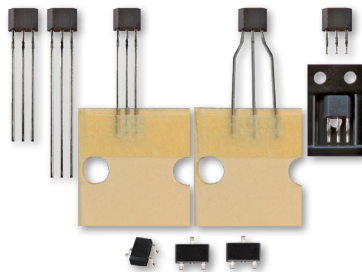
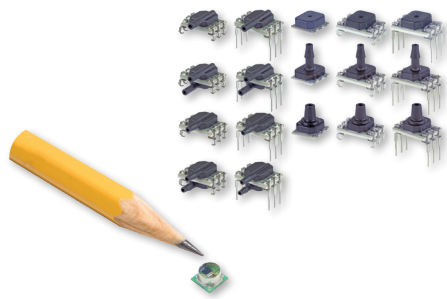
Functions/Actions

- 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

Honeywell force sensors (see Table 1) are typically used within infusion pumps to monitor and control the delivery of fluids, medicines or nutrients to patients. They are used in a non-invasive manner and require no disinfection or sterilization 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



PRESSURE SENSORS – BOARD MOUNT

[Basic ABP/ABP2 Series:](#)
[MicroPressure MPR Series](#)

Function/Action

- Positioned in non-invasive location if peristaltic pump is used to control pressure to the pneumatic pincher rollers

Honeywell’s board mount pressure sensors (see Table 2) can be used to monitor and control the peristaltic pump. Board mount pressure sensors provide high performance with low drift over time. The small form-factor, low-power consumption supports smaller portable designs and the digital simplifies the design of new equipment.

Honeywell board mount pressure sensors are extensively used within medical equipment due to high levels of accuracy, sensitivity and reliability.

TABLE 2. PRESSURE SENSORS – BOARD MOUNT FEATURES

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)

MAGNETIC POSITION SENSOR ICs

[Hall-Effect: SS490; SS360NT, SS360ST, SS460S; Micropower SL353; or](#)
[Magneto-resistive: Nanopower Series](#)

Function/Action

- Monitor placement of tube in pump cavity to ensure proper orientation along with pump motor speed control

Hall-effect position sensor ICs (see Table 3) are designed to provide reliable, accurate output for smooth motor control that reduces noise and vibration in the machine’s motor assembly and improves its efficiency.

The high reliability reduces repair and maintenance costs, and its small size simplifies new designs. A thermally-balanced integrated circuit provides consistent operation over the full temperature range.

TABLE 3. MAGNETIC POSITION SENSORS FEATURES

SS490

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

SS360/SS460

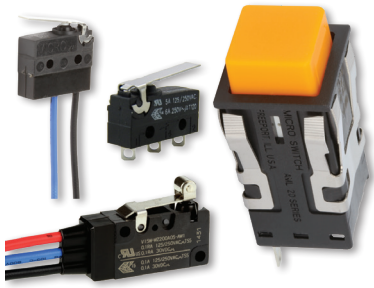
- Fast response time
- High sensitivity
- Latching magnetics

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



BASIC AND AML PUSHBUTTON SWITCHES

[V15W, ZD, ZW Series](#); [AML Series](#)

Function/Action

- Used as on/off operator controls, as well as detection for covers, panels and doors

Honeywell MICRO SWITCH basic switches (see Table 4) can be used as on/off operator controls. Micro Switch basic switches can also be used as presence/detection for covers, panels and doors acting as a fail-safe to prevent switching the machine when doors/panels are ajar. Several series are sealed to protect against fluids.

MICRO SWITCH AML Series are available as pushbuttons, key switches and rockers/paddles. They are often used in medical equipment as off/on operator controls on the external face of the equipment.

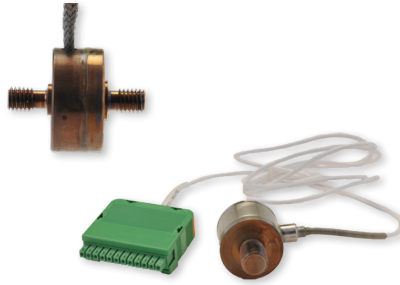
TABLE 4. BASIC AND PUSHBUTTON SWITCHES FEATURES

MICRO SWITCH BASICS

- Watertight, dust tight; leaded versions are sealed to IP67
- High current capacity
- Many different switch characteristics, actuators, and terminations
- Miniature and subminiature size
- Lower power consumption

AML PUSHBUTTONS

- Pushbuttons, paddles, rockers, key-actuated, and indicators within AML Series for coordinated panel appearance
- Less than 1.75 inch panel depth
- Furnished lighted or unlighted



LOAD CELLS - SUBMINIATURE

[Models 31 and 11](#)

Function/Action

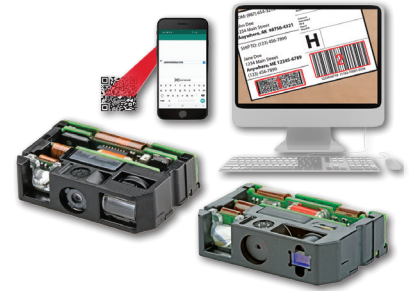
- Monitor the weight of the IV bag to determine the volume of fluid remaining

Honeywell's subminiature load cells (see Table 5) are designed to fit into systems with limited space or tight clearances. Constructed of rugged stainless steel for precise measurements and excellent long term stability and reliability. These load cells are designed to eliminate or reduce to a minimum the effect of off-axis loads.

TABLE 5. SUBMINIATURE LOAD CELLS FEATURES

MODEL 31 AND 11

- Accuracies of 0.25 % to 0.80 % full scale
- Offers load ranges from 150 g up to 1,000 lb
- Miniature and subminiature size
- mV/V output
- Stainless steel
- Single/double diaphragm construction



BARCODE SCAN ENGINES & SOFTWARE

[N670X & N660X](#), [SwiftDecoder™](#)

Function/Action

- Ensure the right treatment is administered to the right patient by reading the barcodes on the IV bag and on the patient wrist band

Honeywell barcode scan engines, modules and decoding software (see Table 6) are used in medical applications to help improve patient safety and enhance operational effectiveness.

Integrating Honeywell barcode reading OEM solutions supports automated, more accurate and faster tracking of patient and caregiver IDs, ensuring the right medication, treatment and equipment match the right patient, and tracking and validating sample IDs and associated information in the work flow.

TABLE 6. SCAN ENGINES AND SOFTWARE FEATURES

N670X, N660X SERIES SCAN ENGINES

- Small form-factor
- Wider operational temperature range
- Available with SR or HD optics
- Parallel or MIPI interface
- Low power consumption

SWIFTDECODER™ SOFTWARE

- Faster barcode scanning
- High accuracy and repeatability
- Reads damaged/poor quality barcodes
- Omni-directional



⚠️ WARNING IMPROPER INSTALLATION

- Consult with local safety agencies and their requirements when designing a machine control link, interface and all control elements that affect safety.
- Strictly adhere to all installation instructions.

Failure to comply with these instructions could result in death or serious injury.

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship during the applicable warranty period. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgement or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items that Honeywell, in its sole discretion, finds defective. **The foregoing is buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.**

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