SpiritIT Flow-X series
Flow computer
For high accuracy measurement data

Highest accuracy in flow computing
- Unique 4-20 mA inputs with HART accuracy
- High accuracy clock and time measurement
- Supports the latest calculations, e.g. AGA-8 Part 2
- 64-bit resolution from input to output

Cost-effective
- Single stream: a single module handles a complete run
- Multi-stream: version 2 module for 3 gas or 2 liquid runs

All the data you ever need
- 4 sets of period data plus batch data
- Recalculated ticket data
- Mass, volume, energy totals per component

Simple hardware concept
- One and the same module used for all enclosures
- No hardware switches, instead fully software configurable

Secure
- Personal user accounts to prevent unauthorized access
- Audit trail shows the actual person

Flexible
- Panel mount, DIN-rail mount, wall mount and 19" rack
- Connects to any Modbus and HART field device
- Web services
- Highly customizable (displays, reports, archives, comms,...)

Complete
- Bi-directional flow
- Support for two provers
- Extensive control functions
- Multi-lingual operator interface

Flow-X/M - Flow computer module

The Flow-X/M module is the core element of the Flow/X series and provides a complete flow computer for gas and liquid flow measurement. The module is placed in one of the Flow-X enclosures, except for the Flow-X/C.

System
- CPU and memory
  - Version 1: 400 MHz, 128 MB RAM, 1024 MB flash
  - Version 2: 800 MHz, 512 MB RAM, 1024 MB flash
- Clock
  - Real-time clock, accuracy better than 1 sec/day
- Battery: version 1 lithium cell, version 2 Goldcap
- Watchdog
  - Hardware and software watchdog timer

Display & buttons
- Display type
  - Graphical 196 x 64 pixel LCD
- White LED, 100 step dimmable
- Buttons
  - 4 navigation buttons
  - Tamper switch
- Mechanical tamper switch to prevent changing of the application and vital parameters within that application

Version 2 with multistream capability
Support for 3 gas or 2 liquid meter runs per module

Physical
- Weight
  - 0.8 kg (1.7 lb)
- Dimensions (w x h x d)
  - 50 x 166 x 115 mm (2.0 x 6.5 x 4.5 inch)

I/O per Flow-X/M module

<table>
<thead>
<tr>
<th>I/O type</th>
<th>Amount</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog inputs*</td>
<td>6</td>
<td>Analog transmitter input, high accuracy. Input types are 4 to 20mA, 0 to 20mA, 0 to 5V, 0 to 5V. Accuracy 0.002% FS at 23°C, 0.008% at full ambient range of 0-60°C, resolution 24 bits. Inputs are fully floating (optically isolated).</td>
</tr>
<tr>
<td>4-wire PRT inputs</td>
<td>2</td>
<td>Resolution 0.02 °C for 100 ohms input. Error depending on range: 0 to 50 °C: Error &lt;0.05 °C or better, –220 to +220 °C: Error &lt;0.5 °C or better</td>
</tr>
<tr>
<td>HART*</td>
<td>4</td>
<td>Independent HART loop inputs, on top of 4 to 20 mA signals. Support includes multi-drop for each transmitter loop, as well as support for redundant FC operation.</td>
</tr>
<tr>
<td>Analog outputs</td>
<td>4</td>
<td>Analog output for flow control, pressure control 4 to 20mA, outputs floating. Resolution 14 bits, 0.075% FS.</td>
</tr>
<tr>
<td>Pulse inputs**</td>
<td>1 or 4</td>
<td>Single or dual pulse input. Adjustable trigger level at various voltages. Frequency range up to 10 kHz (single) or 5kHz (dual). Compliant with ISO6551, IP52, and API 5.5. True Level A and level B implementation.</td>
</tr>
<tr>
<td>Digital inputs**</td>
<td>16</td>
<td>Digital status inputs. Resolution 100ns (10MHz)</td>
</tr>
<tr>
<td>Digital outputs**</td>
<td>16</td>
<td>Digital output, open collector (0.5A DC). Rating 100mA @24V</td>
</tr>
<tr>
<td>Pulse outputs**</td>
<td>4</td>
<td>Open collector, max. 10kHz</td>
</tr>
<tr>
<td>Sphere detector inputs**</td>
<td>4</td>
<td>Supports 1, 2 and 4 detector configurations mode. Resolution 100ns (10MHz)</td>
</tr>
<tr>
<td>Prover bus outputs**</td>
<td>1</td>
<td>Meter pulse output for remote proving flow computers. Resolution 100ns (1MHz).</td>
</tr>
<tr>
<td>Frequency outputs**</td>
<td>4</td>
<td>Frequency output for emulation of flow meter signals. Maximum frequency 10 kHz, accuracy 0.1%.</td>
</tr>
<tr>
<td>Serial</td>
<td>2</td>
<td>RS485 / RS232 serial input for ultrasonic meter, printer or generic. 115kb</td>
</tr>
<tr>
<td>Ethernet</td>
<td>2</td>
<td>RJ45 Ethernet interface, TCP/IP</td>
</tr>
</tbody>
</table>

Table 1: I/O per Flow-X/M module

* Analog input = 6 (of which 4 support HART)
** Total number of pulse inputs + digital inputs + digital outputs + pulse outputs + density inputs + sphere detector inputs + prover bus outputs + frequency outputs = 16
(i) Version 1 hardware supports 1 dual pulse input, while version 2 hardware supports 4 dual pulse inputs
(ii) Version 1 hardware supports single pulse outputs only, while version 2 also supports dual pulse outputs with a phase shift
Enclosures for the Flow-X/M

The Flow-X module can be used in several different enclosures. The Flow-X/S and Flow-X/K are single module enclosures providing respectively onboard wiring terminals and remote IO connectivity through 37 pins D-sub connectors. The Flow-X/P is a multi-stream flow computer with an integrated station module and touch screen and can hold up to 4 modules. The Flow-X/C is the compact version of the Flow-X/P with one module integrated into the enclosure. The Flow-X/R is a 19 inch rack enclosure for up to 8 modules.

System specifications

Environmental Data
- Ambient operating temperature: 0 to 60 °C
- Storage temperature: -20 to 70 °C
- Operating humidity: Max. 90% relative humidity, non-condensing
- Sunlight: Store and operate out of direct sunlight

Power Supply
- DC power supply: External, 24 V DC (± 10%), with redundant connections

Power Consumption

<table>
<thead>
<tr>
<th>Module</th>
<th>Nominal Consumption</th>
<th>Startup Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow-X/P0</td>
<td>0.3 A</td>
<td>0.8 A</td>
</tr>
<tr>
<td>Flow-X/C</td>
<td>0.5 A</td>
<td>1.0 A</td>
</tr>
<tr>
<td>Flow-X/M</td>
<td>0.3 A</td>
<td>0.8 A</td>
</tr>
</tbody>
</table>

Communication protocols
- Modbus RTU / ASCII Master and Slave
- Modbus TCP Server and Client
- HART Master
- Flow-X Client protocol
- Web services API

Flow meter diagnostics

- ABB CoriolisMaster
- SICK FlowSIC 600
- SICK FlowSic 600XT
- E+H Promass
- Caldon LEFM 380CI
- FMC MPUS
- GE Panametrics GF688
- Faure Herman 8400
- Q.Sonic plus
- Micro Motion
- AltoSonic V12
- RMG US20B

Gas analyzers

- ABB NGC 8200 series
- ABB BTU8100
- Siemens Masum
- Siemens Sitrans
- Danalyzer
- Yamatake HGC
- Encal 3000
- Angus QQA

Density Meters

- Density Meters
- Solartron
- Sarasota
- UGC
- Densitrak
- Anton Paar L-Dens 427 (HART/Modbus)

Calculations

- Liquid
  - API 5, 6, 23, 24, 53, 54, 59 and 60 tables (A.B. D and E)
  - API 11.1980 (API 2540) and 2004/2007
  - API 1952 historical tables
  - API 11.2.1, 11.2.2, 12.2, 21.1, 21.2
  - API 11.3.2.1 Ethylene (API-2565)
  - GPA TP15, TP16, TP25, TP27
  - Propylene (API 11.3.3.2)
  - Butadiene (ASTM D1550)
  - Ethylene (UPAC 1988, NIST 1045, API 2565)
  - Carbon dioxide (NIST)
  - Ethanol / Alcohol (OIML R22)

Gas

- AGA, AGA7, AGA8 Parts 1 and 2, AGA10, AGA11
- AGA-AX19
- SGERG-88
- GERP-2008
- GOST 30319-2
- GPA 2172
- IAPWS-IF97 (steam and water)
- ISO 6976 (all editions)
- GSSSD M8113

Flow

- ISO 5167-1, 2, 3 and 4 (all editions)
- ISO/TR13777
- AGA3
- GOST 8-586
- V-cone
Software applications

<table>
<thead>
<tr>
<th></th>
<th>Gas Metric</th>
<th>Gas USC</th>
<th>Liquid Metric</th>
<th>Liquid USC</th>
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</thead>
<tbody>
<tr>
<td><strong>Base engineering units</strong></td>
<td>Metric</td>
<td>US Customary</td>
<td>Metric</td>
<td>US Customary</td>
</tr>
<tr>
<td><strong>Product</strong></td>
<td>Natural gases, industrial gases and steam</td>
<td>Crude oil, oil and liquid products, natural gas liquids, liquefied gases and water</td>
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<tr>
<td><strong>Flow meter signal</strong></td>
<td>Pulse, analog, Modbus, HART</td>
<td>Pulse, analog, Modbus, HART</td>
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<tr>
<td><strong>Flow meter type</strong></td>
<td>Ultrasonic, Turbine, Coriolis, PD, Orifice, Cone, Venturi</td>
<td>Coriolis, Turbine, Ultrasonic, PD, Orifice, Cone, Venturi</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of runs (streams)</strong></td>
<td>1 for Flow-X/M version 1</td>
<td>1 for Flow-X/M version 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 for Flow-X/P version 1 (1 per module)</td>
<td>4 for Flow-X/P (1 per module)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Remote station capability</strong></td>
<td>For maximum 8 runs in total</td>
<td>For maximum 8 runs in total</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>Valve, flow, sampler</td>
<td>Valve, proving, batch, flow, sampler, loading, LACT, driver authorization</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Proving</strong></td>
<td>Up to 2 master meters</td>
<td>Up to 3 sphere provers, compact provers and/or master meters</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flow direction</strong></td>
<td>Forward and reverse</td>
<td>Forward and reverse</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>K-factor / Meter factor curve</strong></td>
<td>12 points</td>
<td>12 points</td>
<td></td>
<td></td>
</tr>
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</table>

Regulatory compliance

**EU Directives**
2014/32/EU Measuring Instruments Directive
2014/30/EU Electromagnetic Compatibility Directive
2012/19/EU WEEE Directive (WEEE 2)
2011/65/EU RoHS

**UL / CSA**
CAN/CSA C22.2 No 61010-1:2012/05/11 Ed.3
ANSI/UL 61010-1, Issued 2012/05/11 Ed.3

**IEC Standards**
IEC 60068-2-1
IEC 60068-2-2
IEC 60068-2-3
IEC 60068-2-31
IEC 60068-2-36
IEC 60654-2
IEC 61000-4-2:2008
IEC 61000-4-4:2012
IEC 61000-4-5:2015 + A1:2017
IEC 61000-4-6:2014
IEC 61000-4-8:2009
IEC 61000-4-29:2000
IEC 61000-6-2:2016
IEC 61000-6-4:2005 + A1:2011

Flow-X/S specifications

**Physical**
Dimensions (w x h x d) (with module)
142 x 250 x 164 mm (5.6 x 9.8 x 6.5 inch)

Weight (with module)
2.5 kg (5.4 lbs)

Mounting options
Wall mounted, 4 screws
DIN rail, 2 rails

Modules
1

Streams (meter runs)
1 gas or 1 liquid with version 1 module
3 gas or 2 liquid with version 2 module

Connectors
**Ethernet**
2 x shielded 8 pole snap-in R245 connectors

**Power**
1 x 8 pole connector
(Phoenix Contact, MSTBVA 2.5/8-G-5.08)

I/O
2 x screw terminal strips with each 39 terminals
(Phoenix Contact, SMKDS 2.5/3-5.08)
Flow-X/K specification

Physical
Dimensions (w x h x d) (with module)
60 x 353 x 131 mm (2.4 x 13.9 x 5.2 inch)
Weight (with module)
1.7 kg (3.6 lbs)
Mounting options
Wall mounted, 4 screws
DIN rail, 2 rails
8 Height units (U) in a 19 inch rack (with DIN rail adapter)
Modules
1
Streams (meter runs)
1 gas or 1 liquid with version 1 module
3 gas or 2 liquid with version 2 module

Connectors
Ethernet
2 x shielded 8 pole snap-in RJ45 connectors
Power
1 x 4 pole connector
(Phoenix Contact, MSTBVA 2.5/4-G-5.08)
I/O
2 x 37-pin D-sub female connectors

Flow-X/C specification

Physical
Dimensions (w x h x d)
139 x 237 x 142 mm (5.5 x 9.3 x 5.6 inch)
Weight
2.7 kg (6.0 lbs)
Mounting options
Enclosure is delivered with mounting bracket for
installation in a cabinet (Panel mounted)
Modules
1 (integral part of the enclosure)
Streams (meter runs)
3 gas or 2 liquid

Connectors
Ethernet
2 x shielded 8 pole snap-in R345 connectors
Power
1 x 4 pole connector
(Phoenix Contact, MSTBVA 2.5/4-G-5.08)
I/O
1 x 9-pin D-sub male connector
2 x 37-pin D-sub female connectors

Figure 6 DIN rail mount
Figure 7 Wall mount
Figure 8 Side view with bracket
Figure 9 Side view with bracket
Flow-X/P specification

Physical
Dimensions (w x h x d) (without bracket)
137 x 235 x 322 mm (5.4 x 9.3 x 12.7 inch)
Weight
3.7 kg (8.2 lbs)
Mounting options
Enclosure is delivered with mounting bracket for installation in a cabinet (Panel mounted)
Modules
0 to 4
Streams (meter runs)
Up to 4 gas or 4 liquid (1 per module)

Connectors
Ethernet
2 x shielded 8 pole snap-in RJ45 connectors
Power
1 x 8 pole connector
(Phoenix Contact, MSTBVA 2.5/8-G.5.08)
I/O
3 x 9-pin D-sub male connectors
8 x 37-pin D-sub female connectors

Flow-X/R specifications

Physical
Dimensions (w x h x d)
482 x 355 x 135 mm (19.0 x 14.0 x 5.3 inch)
Weight
5.0 kg (11.0 lbs)
Mounting options
Front mounted for in a 19 inch rack (8 Height units U) (Figure 16)
Back mounted for wall mounting (Figure 17)
Modules
1 to 8
Streams (meter runs) per module
1 gas or 1 liquid with version 1 module
3 gas or 2 liquid with version 2 module

Connectors
Ethernet
2 x shielded 8 pole snap-in RJ45 connectors
Power
1 x 8 pole connector
(Phoenix Contact, MSTBVA 2.5/8-G.5.08)
I/O
3 x 9-pin D-sub male connectors
8 x 37-pin D-sub female connectors
Flow-X/T specification

External Touch screen

Physical
Weight
0.7kg (1.43 lbs) | 1.7 kg (3.75 lbs)
Dimensions (w x h x d)
222 x 152 x 56 mm (8.7 x 6.0 x 2.2 inch)
280 x 227 x 56 mm (11.0 x 8.9 x 2.2 inch)
Mounting options
Panel installation with mounting brackets (included)
Panel cutout, see figure 16 & 17 on the next page
Operating temperature
0 °C – 70 °C

EMI/EMC Certifications
CE/FCC/KCC Class A

Display
Display Type
7” TFT-LCD (800 x 480 px) | 10.4” TFT-LCD (800 x 600 px)
Backlight
LED Backlight (ON/OFF switchable)
Touch
4 wire resistive panel

Connectors
Ethernet
1 x RJ-45 (100 Base-TX)
Power
12V – 24 V DC (500mA | 800mA)

Compatible with
All Spirit™ Flow-X computers

Flow-X/B specifications

Break out board
Breakout board with pull-up resistors, fuses & relays for easy field connectivity and to protect the flow computer from any misuse or field influence. Embedded green and red LED lights for simple signal overview of flow equipment. One Flow-X/B board is required for each 37-pin D-Sub connector.

Physical
Dimensions (w x h x d)
177 x 130 x 55 mm (7.0 x 12.2 x 2.2 inch)
Weight
1.2 kg (2.6 lbs)
Mounting options
Wall mounted, 4 screws

Connectors
Power
1 x 5 pole header and plug connector
Field I/O
8 x 5 pole header and plug connector (DI)
2 x 3 pole header and plug connector (AO)
3 x 3 pole header and plug connector (AI)
1 x 4 pole header and plug connector (PRT)
1 x 4 pole header and plug connector (I/O_GND)
(WE, Serie 311 & 3445-5.08mm)

Compatible with
All Spirit™ Flow-X computers, except Flow-X/S
1 x 5 pole header & plug connector
(WE, Serie 311 & 3445-5.08mm)
Flow-X/I/O
1 x 37-pin D-sub female connectors

1 Fuses and relays are NOT included with the delivery of the Flow-X/B.
### Terminal block specification
37 pin Sub D Terminal Block with cable
- **Type**
  - DECA MOD-37-F02
- **Dimensions (w x h)**
  - 113 x 85.2 mm (4.4 x 3.4 inch)
- **Connectors**
  - 1 x 37-pin D-sub female connectors
- **Cable**
  - 1, 2 or 3 meter; straight or 45° angled
- **Compatible with**
  - All Spirit® Flow-X computers, except Flow-X/S

### Connector overview
#### Power supply
**4 pin power terminal**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24V Primary +1</td>
</tr>
<tr>
<td>2</td>
<td>24V Secondary +2</td>
</tr>
<tr>
<td>3</td>
<td>0V</td>
</tr>
<tr>
<td>4</td>
<td>0V</td>
</tr>
</tbody>
</table>

**8 pin power terminal**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COM1 Rx</td>
</tr>
<tr>
<td>2</td>
<td>COM1 —</td>
</tr>
<tr>
<td>3</td>
<td>COM2 Tx</td>
</tr>
<tr>
<td>4</td>
<td>COM2 —</td>
</tr>
<tr>
<td>5</td>
<td>0V</td>
</tr>
<tr>
<td>6</td>
<td>0V</td>
</tr>
<tr>
<td>7</td>
<td>24V</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
</tr>
</tbody>
</table>

#### Screw terminals Flow-X/S
**Connector A (X1A)**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24V out</td>
</tr>
<tr>
<td>2</td>
<td>0V, Digital common</td>
</tr>
<tr>
<td>3</td>
<td>0V, Digital common</td>
</tr>
<tr>
<td>4</td>
<td>0V, Digital common</td>
</tr>
<tr>
<td>5</td>
<td>0V, Digital common</td>
</tr>
<tr>
<td>6</td>
<td>0V, Digital common</td>
</tr>
<tr>
<td>7</td>
<td>0V, Digital common</td>
</tr>
<tr>
<td>8</td>
<td>0V, Digital common</td>
</tr>
<tr>
<td>9</td>
<td>0V, Digital common</td>
</tr>
<tr>
<td>10</td>
<td>0V, Digital common</td>
</tr>
<tr>
<td>11</td>
<td>0V, Digital common</td>
</tr>
<tr>
<td>12</td>
<td>0V, Digital common</td>
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<td>13</td>
<td>0V, Digital common</td>
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<td>15</td>
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<td>16</td>
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<td>17</td>
<td>0V, Digital common</td>
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<td>18</td>
<td>0V, Digital common</td>
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<td>19</td>
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<tr>
<td>20</td>
<td>0V, Digital common</td>
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<tr>
<td>21</td>
<td>24V out</td>
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<tr>
<td>22</td>
<td>0V, Digital common</td>
</tr>
<tr>
<td>23</td>
<td>0V, Digital common</td>
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<td>24</td>
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<td>25</td>
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<td>27</td>
<td>0V, Digital common</td>
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<td>28</td>
<td>0V, Digital common</td>
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<tr>
<td>29</td>
<td>0V, Digital common</td>
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<tr>
<td>30</td>
<td>0V, Digital common</td>
</tr>
<tr>
<td>31</td>
<td>0V, Digital common</td>
</tr>
<tr>
<td>32</td>
<td>COM1 Rx</td>
</tr>
<tr>
<td>33</td>
<td>COM1 Tx</td>
</tr>
<tr>
<td>34</td>
<td>COM2 Rx</td>
</tr>
<tr>
<td>35</td>
<td>COM2 Tx</td>
</tr>
<tr>
<td>36</td>
<td>COM3 Rx</td>
</tr>
<tr>
<td>37</td>
<td>COM3 Tx</td>
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**Connector B (X1B)**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>COM1 Rx</td>
</tr>
<tr>
<td>2</td>
<td>COM1 —</td>
</tr>
<tr>
<td>3</td>
<td>COM2 Tx</td>
</tr>
<tr>
<td>4</td>
<td>COM2 —</td>
</tr>
<tr>
<td>5</td>
<td>0V</td>
</tr>
<tr>
<td>6</td>
<td>0V</td>
</tr>
<tr>
<td>7</td>
<td>0V</td>
</tr>
<tr>
<td>8</td>
<td>0V</td>
</tr>
</tbody>
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### D-SUB 9 connector (Male)
**COM1**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
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</thead>
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<tr>
<td>1</td>
<td>RX</td>
</tr>
<tr>
<td>2</td>
<td>TX</td>
</tr>
<tr>
<td>3</td>
<td>DTR</td>
</tr>
<tr>
<td>4</td>
<td>DSR</td>
</tr>
<tr>
<td>5</td>
<td>DCD</td>
</tr>
<tr>
<td>6</td>
<td>RTS</td>
</tr>
<tr>
<td>7</td>
<td>CTS</td>
</tr>
</tbody>
</table>

**COM2 & COM3**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
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**COM3 only**

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### D-SUB 37 connector (Female)
**Connector A**

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**Connector B**

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* RS-232/RS-485 2 wire / RS-485 4 wire

**Flow-X/C COM3 only**

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**Flow-X/K COM2 & COM3**

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**Flow-X/R COM2**

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### Pin Description
- **Connector A (X1A)**
  - **D-SUB 37 connector (Female)**
  - **Connection**
    - **D-SUB 9 connector (Male)**