

Installation and Operational Manual for the 4120.30 i-captor

For accurate monitoring of flow and temperature



General Specifications

Type	Flow and temperature
Pressure	up to 100 bar (1,450 psi)
Response time	Max 5 seconds normal flow
Initial operation	approx. 10 s after connection of power

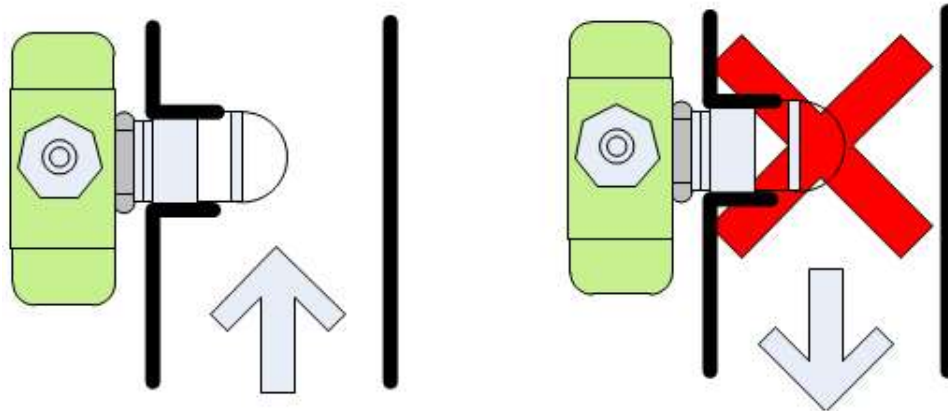
Products	
Type code	i-captor 4120.30
Interface	4-20mA Flow and Temperature, RS-485 Modbus RTU for all outputs
Sensor Data	
Flow Range	0-300 cm/s
Temperature Range	0° C to 100° C
Medium Temperature	-20 °C to +80 °C (-4 °F to 158 °F)
Ambient Temperature	-20 °C to +70 °C (-4 °F to 176 °F)
Pressure	Max 100 bar (1450 PSI)
Protection standard	IP 65
Initial operation	Approx. 10s after connection of power
Response Time	2s - 8s depending on flow
Accuracy	+/- 2% over range
Repeatability	<2%
Temperature drift	<0.1%/K
Body dimensions	56mm x 56mm x 28mm + Probe Length (2.25" x 2.25" x 1.125" + Probe Length)
Weight	200g (7 oz)
Electrical Data	
Operating voltage	18 to 30 VDC, incl. residual ripple
Current consumption	Max. 250 mA (pulsed)
Power consumption	Approx. 1W
Circuit protection	Reverse polarity, short circuit, and overload
Cable core color codes	
1. White (4-20mA flow)	5. Grey (RS-485 B)
2. Brown (4-20mA temperature)	6. Pink (future sensor) unused
3. Green (24VDC)	7. Blue (future sensor) unused
4. Yellow (RS-485 A)	8. Red (0VDC)

Installing the "i-captor"

Please read these instructions carefully and work safely at all times. Improper installation can void the warranty. In no event will Weber Sensors be liable for any direct, indirect, punitive, incidental, special consequential damages, to property or life, whatsoever arising out of or connected with the use or misuse of its products.

Piping Position

- ✓ Because the sensing resides at the very tip of the instrument, accuracy can be lost if the tip is not immersed in liquid at all times.
- ✓ The preferred location is a vertical discharge line as opposed to a vertical return line which may have air pockets as illustrated below.



- ✓ If the i-captor is installed on a horizontal line the best location to ensure constant liquid contact is the side of the pipe as opposed to the top where cavitation bubbles are more likely to exist.
- ✓ The i-captor should be installed in straight pipe with minimum turbulence, at least 5 pipe diameters upstream and 3 pipe diameters downstream of any fittings such as elbows, tees or reducers and at least 15 pipe diameters from any pumps.

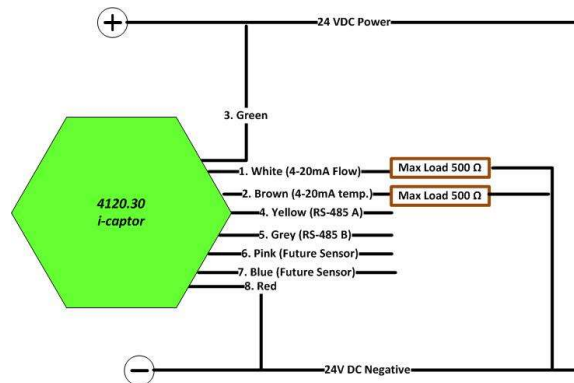
Installation

- ✓ The tip of the i-captor should protrude into the liquid a minimum of 1/5th of an inch (5 mm).
- ✓ It is highly recommended that the i-captor be installed in either a welded or saddle tee rather than a threaded tee which could create turbulence and affect the accuracy.
- ✓ The pipe threads of the i-captor should be sealed with either Teflon tape or other commercial grade non-thermal conductive pipe sealant.
- ✓ Tighten the i-captor with a wrench using the metal hex nut at the base of the plastic housing.

Never use the plastic housing to tighten the i-captor into the pipe.

Electrical

- ✓ Insert the M12 connector gently into the housing, and do not force it as it only fits one way.
- ✓ With the 24VDC power source off, connect the green wire from the i-captor to positive (+) and the red wire to negative (-).
- ✓ For Modbus applications connect the yellow wire and the grey wire to the Modbus master.
- ✓ For analog applications, the white wire provides a 4-20mA output for flow (Analog Output A), and the brown wire provides a 4-20mA output for temperature (Analog output B).



- ✓ Turn on the power source.
- ✓ After the power has been applied for ten seconds or so the green "Act" LED will begin to blink.
- ✓ The i-captor is factory calibrated, but the analog range can be field scaled by using the Set button as described below:
 - For the analog flow output:
 - To set the Maximum Flow (20mA):
 - When the flow is at maximum, hold the "Set" button down until the Act light blinks twice
 - The output will become 20mA
 - To set the Minimum Flow (4mA – mainly for non-water solutions)
 - When the flow is at minimum, hold the Set button down until the Act light blinks 4 times
 - The output will become 4mA
- ✓ The Modbus version provides a means to set the minimum flow through register "1136". Flows below this setting are presented as 0.
- ✓ Temperature is fixed at 4mA = 0°C (32F) and 20mA=100°C.(212F)
- ✓ Modbus Registers:
 - The following table indicates key Modbus registers and their default values; all read/write (RW) values can be changed by the operator. **Caution:** Please pay attention to the data type formats. Ensure that the data entered into i-captor matches the format required. For example, do not put integer values into floats and vice versa. Register values are presented as [F2] where F is data type (Float) and 2 is the register number.

Legend		
Register	All Registers are holding registers	
RW	R	Read-Only
	RW	Read Write
NV	Value is stored in flash	
Format	C	Character value (1 Modbus register)
	I	Integer value (1 Modbus register)
	L	32-bit Integer, MSB first (2 Modbus registers)
	F	32-bit floating point; Upper 16-bits (MSR) in lowest-numbered / first listed register (257/258 = MSR/LSR). Encoding is per IEEE standard 754 single precision.
	S	String (8 chars)
	LS	Long String (20 chars)

Register	RW	NV	Format	Range	Description
Measurements					
0	R		F		Volumetric Flow
2	RW		F		Totalized Flow
4	R		F	0-100°C	Temperature
6	R		F	0-3 m/s	Flow Velocity
100	R		I		Cycle Count
Modbus					
512	RW	NV	I	1-254	Modbus Slave Address [42]
514	RW	NV	L	300-115200	Baud Rate [38400]
Units					
1000	RW	NV	I		Units of measure [1]. See table below; this sets all the registers in this group except 1256, 1136, and 1140
70	RW	NV	S		velocity description automatically set by register 1000 eg "m/s"
50	RW	NV	S		As above for volume flow units; eg "lpm"
60	RW	NV	S		As above for temperature unit; eg "C"



80	RW	NV	S	As above for totalizer units; eg "liters"
90	RW	NV	S	As above for pipe size units; eg, "mm"
1256	RW	NV	F	Inner diameter of the pipe
1136	RW	NV	F	Minimum readable velocity (velocities below this threshold will read as 0)

Identity

903	R	NV	L	Serial Number
905	R	NV	I	Hardware Revision
910	RW	NV	LS	Sensor Location Identifier (eg chilled water 2)
920	R	NV	I	Temp Exceeded Flag
950	R	NV	S	Device Identity String (i-captor 4.102)

Configuration (Only required to change if using both 4-20mA outputs *and* Modbus simultaneously)

804	RW	NV	I	4-20mA "A" output selector
805	RW	NV	F	4-20mA "A" lower control limit
807	RW	NV	F	4-20mA "A" upper control limit
814	RW	NV	I	4-20mA "B" output selector
815	RW	NV	F	4-20mA "B" lower control limit
817	RW	NV	F	4-20mA "B" upper control limit

Master Unit Mode	Refers to register 1000
0	Mixed/Custom
1	C, m/s, LPM, Liters
2	F, ft/s, GPM, Gallons
3	F, ft/s, GPH, Gallons

Selector	Registers 804 and 814
1	Temperature
2	Velocity
3	Volumetric Flow
4	Totalizer



- ✓ The i-captor comes from the factory with a default Modbus ID of (42) located at register [C512] and communicates at a default baud rate of (38400) located at register [I513]. **Since no two Modbus devices can properly communicate with the same ID it is important to ensure the i-captor's Modbus ID is unique (especially if you have more than one i-captor on the same network) and the baud rate is set to the proper speed of your network.** The Modbus ID can be between 1-254 and the baud rates supported are as follows:
 - 110
 - 600
 - 2400
 - 9600
 - 19200
 - 38400
 - 57600
 - 300
 - 1200
 - 4800
 - 14400
 - 28800
 - 56000
 - 115200
- ✓ Changing the Modbus ID and baud rate
 - **Caution:** once registers [I512] and/or [L514] are changed the i-captor will immediately change to the entered values and no longer communicate to the default values.
 - If a problem occurs during this process, follow the directions below to perform a factory reset which will return the i-captor to the default Modbus ID of (42) and baud rate of (38400).
- ✓ Location, Master Unit Mode, and Pipe Inside Diameter
 - Register [LS910] is an operator-defined string that is 20 chars long which identifies the i-captor's location in your plant (for example "ChW LoopA In" or "ProcessLine22").
 - The Master Unit Mode register [I1000] sets the units of measure. For example a value of (2) sets the output for Imperial Units in (F, ft/s and GPM) whereas a value of (1) sets the output to Metric, (C, m/s, LPM). See the chart above for more detail.
 - If changing the units, remember to set F805/F807 and F815/F817 to set the correct range for the 4-20mA outputs (eg, if you change to Imperial units, you probably want to set at least F815=32.0 and F817=212.0 to maintain the same "freezing to boiling" span that was set at the factory)
- ✓ Analog Configuration if using both Modbus and 4-20mA outputs
 - The i-captor has (2) 4-20mA analog outputs; from the factory, A=velocity (0-3m/s) and B=temperature (0-100C), but what each analog output represents can be changed by using the selector register (eg, if you'd rather have a Totalizer 4-20mA output instead of Temperature, set I814=4).
 - Each of the 4-20mA analog channels' ranges can be set using Modbus registers in lieu of using the SET button. This is accomplished via register F805 and F815 which are the lower control (4mA point) settings. The upper control limit (20mA point) registers are F807 and 817 respectively; For example, if the system flow is between 0-1.5m/s, you may wish to make 1.5m/s be the 20mA point by setting F805=1.5 (this the same as holding the SET button down for 4 blinks while flowing 1.5m/s)

- ✓ To obtain an accurate volumetric reading set register [F1265] to the proper Inside Pipe Diameter of the pipe the i-captor is installed in. For example, assuming the Master Unit Register [I1000] is set to 2 for Imperial units, and the i-captor is installed in a 14" schedule 40 steel pipe the correct inside diameter of 13.13 would be entered indicating the internal diameter in inches as opposed to mm for metric.
- ✓ Once the proper internal pipe diameter is entered, the volumetric flow can be read at register [F0].
- ✓ Register [F2] has a read write (RW) capability and reads the totalized volume flow through the i-captor. To reset the totalized flow, simply write a "0" to the register.
- ✓ The units of measurements can be read in registers [S50-S80]. These units can be customized by the operator to match the naming consistency of any plant operation.
- ✓ Register [I100] increments by 1 each time the i-captor performs a measurement. This allows monitoring to be optimized by triggering only after a change occurs.
- ✓ **The i-captor can be reset to factory defaults (0-3 m/s range, default baud rate of 38400 and Modbus ID of 42) by holding the Set button down until the Act light blinks 7 times.**

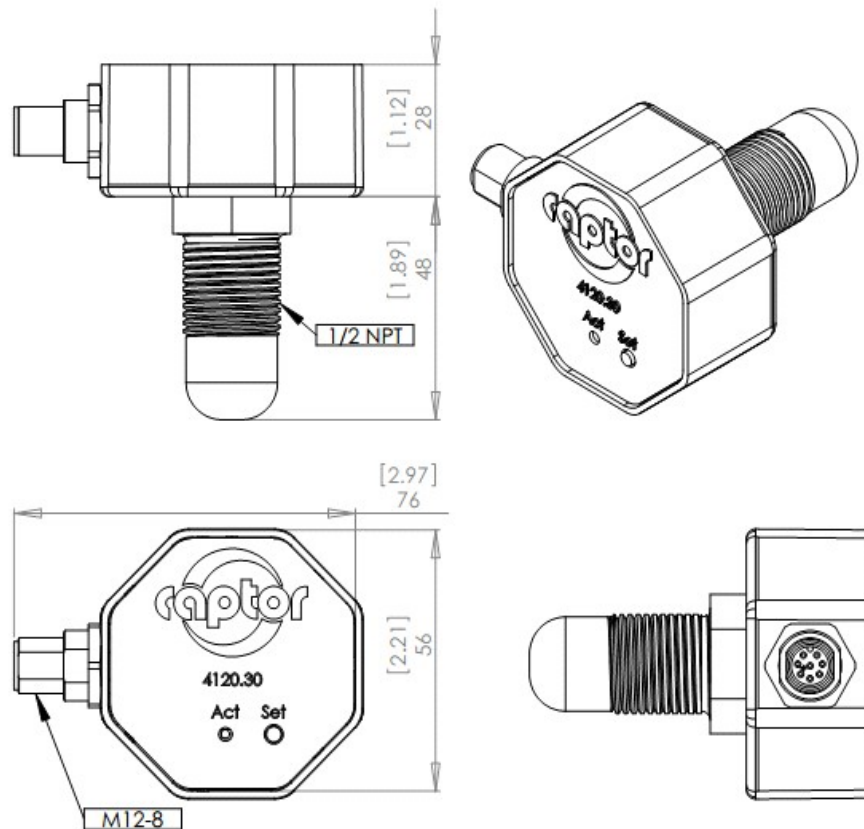


Figure 1. Dimensional Drawings (30mm NPT shown)