altrac
Pump Station 2.0

Model Number:

ST140_3G

ST140_5G

User's Manual
Revised March 25, 2021

Table of Contents

Please contact us if you have any questions.
Web: https://altrac.io/support
Phone: (510) 248-4141
Email: support@altrac.io

Specifications

Model	ST140_3G	ST140_5G
Cellular Modem	2G/3G	LTE CATM1 (5G)
Cellular Networks	AT&T & T-mobile	AT&T
Power Supply	15 VDC	
Peak Electrical Consumption	25W	
Wiring	Minimum 20 AWG, Twisted Pair, Shielded Cable	
Operating Temperatures	-40°C to 80°C (-40°F to 176°F)	
Weatherproofing	IP66, NEMA 1,2,3,3R,4,4X,12,13	
Enclosure Material	PBT/PC Blended Plastic	
UL Rating	UL94V-0 Flammability Rating	
Sunlight Protection	UV Stabilized	
ON/OFF Button	Included	
Relay 1	6A, 250VAC, 85°C	
Relay 1 Feedback	Power Output: 30mA @ VIN or 15mA @ 12.5V Sensor Inputs: 4-20mA, 0-10VDC, Contact Closure	
Relay 2	6A, 250VAC, 85°C	
Relay 2 Feedback	Power Output: 30mA @ VIN or 15mA @ 12.5V Sensor Inputs: 4-20mA, 0-10VDC, Contact Closure	
Analog Sensor: Pressure Sensor 1	Power Output: 30mA @ VIN or 15mA @ 12.5V Sensor Inputs: 4-20mA, 0-10VDC, Contact Closure	
Analog Sensor 2: Pressure Sensor 2 (Accessory Port)	Power Output: 1A @ 12.5V Sensor Inputs: 4-20mA, 0-10VDC, Contact Closure	
Flow Meter	Optically Isolated Pulse Input 10mA @ 12VDC	
Digital Input 1: HOA Switch Location	Contact Closure Pulled Up to VIN @ 12mA	
Digital Input 2: Open	Contact Closure Pulled Up to VIN @ 12mA	
Digital Input 3: Open	Contact Closure Pulled Up to VIN @ 12mA	
RS485/RS232: VFD Communication	Available: Contact Altrac Support	

Altrac is continually updating and improving products; specifications are subject to change without prior notice.

Consumer Safety Information

⚠ This is the safety alert symbol. This symbol alerts you to potential hazards that can kill or hurt you or damage the ST140 Pump Station or associated equipment.

Safety Behavior and Practices

• Installing the Pump Station should only be done by a licensed electrician following local codes. Improper installation could result in shock or fire hazard.

• Do not install the ST140 in a location where water is frequently present. The enclosure is IP67 protected, but water can still enter the enclosure if pooled on the surface or in a connector.

• Do not use this device if any part has been under water. Immediately call a qualified service technician to inspect the device and to replace any part of the control system that is damaged.

• This device (when equipped with PW200) uses a three-prong plug for your protection against shock hazard and should be plugged directly into a proper grounded three-prong receptacle. Do not cut or remove the ground prong from this plug.

• Any alteration to the device or its controls can be dangerous and will void the warranty.

Safety Features

• The ST140 is designed to resist electrical interference if shielded cable is used.

• The ST140 downloads the latest settings and will reload those settings if power is cut. For example, if the ST140 looses cellular connection, it will continue running according to it schedule.

• The ST140 utilizes automotive grade components to resist vibration and heat damage.

Description of Operation

The ST140 Pump Station allows you to remotely monitor and control VFD, Soft Start, Contactor and Relay driven pumps. Each ST140 contains a cellular modem with connection to the Altrac Cloud. Using the Altrac Web App you can control your pump on your smartphone, tablet, or desktop computer. The ST140 also has a physical button you can use to turn the pump on and off when you don't have access to a smart device.

The Pump Station monitors and controls up to two pumps. It is designed to control a primary irrigation pump and a secondary pump such as for fertigation or sulfur burner. The ST140 monitors pump state(s), HOA switch position, a flow meter, and two pressure sensors for irrigation line pressure.

The Pump Station sends and retrieves data from the cloud every 10 minutes while connected to a power source. During pump operation, the Station updates every 5 minutes or less. If a sensor value changes dramatically the Station will update immediately.

Features

Software Package*	Standard Software	SW142: Advanced Software Features
Connection Frequency	Every 10 minutes when pump is OFF. Every 5 minutes or less when pump is ON.	
Webapp Access	Included	
Pump 1 Remote Control	Included	
Pump 2 Remote Control	Not Included	Included
Pump Scheduling Software	Included	
Flow Meter: Instant Flow Rate	Included	
Flow Meter: Cumulative Flow	Not Included	Included
Pressure 1 (PSI)	Included	
Pressure 2 (PSI)	Not Included	Included
Pressure Differential	Not Included	Included
Alerts: Text, Email, Phone	Included	
Reports: Daily, Weekly, Yearly	Included	
RS485/RS232: VFD Communication	Not Included	Available: Contact Altrac Support
Frost Water Automation Software	Available	

*Software packages can be upgraded at any time. If you would like to update your software package please contact support@altrac.io.

Standard Installation

Primary Pump

Control the primary pump with Relay 1 via the pump's VFD or other start/stop mechanism. Pump must return a signal while running.

Post Filter Pressure Sensor

The ST140 can monitor a pressure transducer post filter to monitor filter flushing and send alerts.

Flow Meter

The ST140 monitors one flow meter to record output. A pulse output is needed.

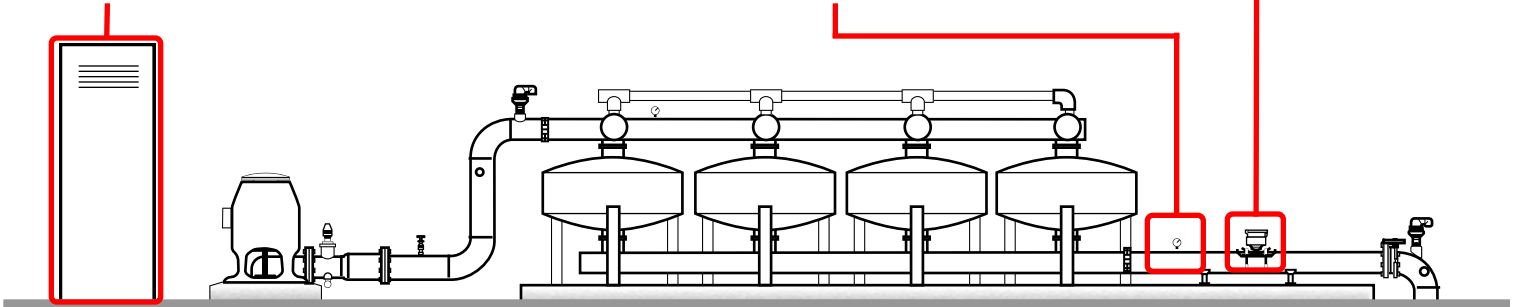## Advanced Installation (SW142)

Primary Pump

Control the primary pump with Relay 1 via the pump's VFD or other start/stop mechanism. Pump must return a signal while running.

Pre Filter Pressure Sensor

The ST140 can monitor a pressure transducer pre filter to determine proper pump operation.

Flow Meter

The ST140 monitors one flow meter to record output. A pulse output is needed.
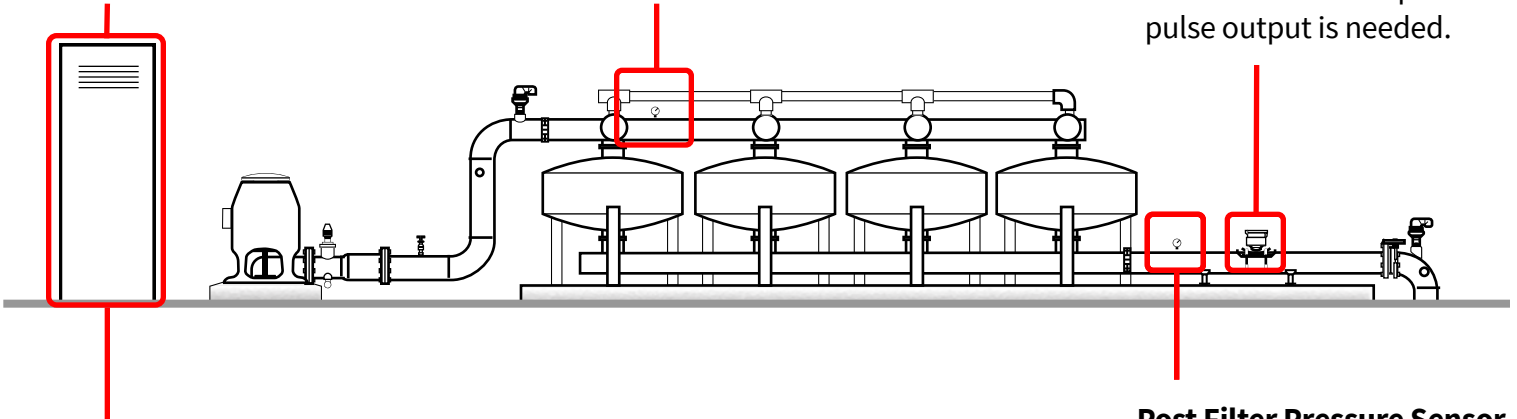
Secondary Pump

Control a secondary pump or device with Relay 2. Device must return a signal while running.

Post Filter Pressure Sensor

The ST140 can monitor a pressure transducer post filter to monitor filter flushing and send alerts.
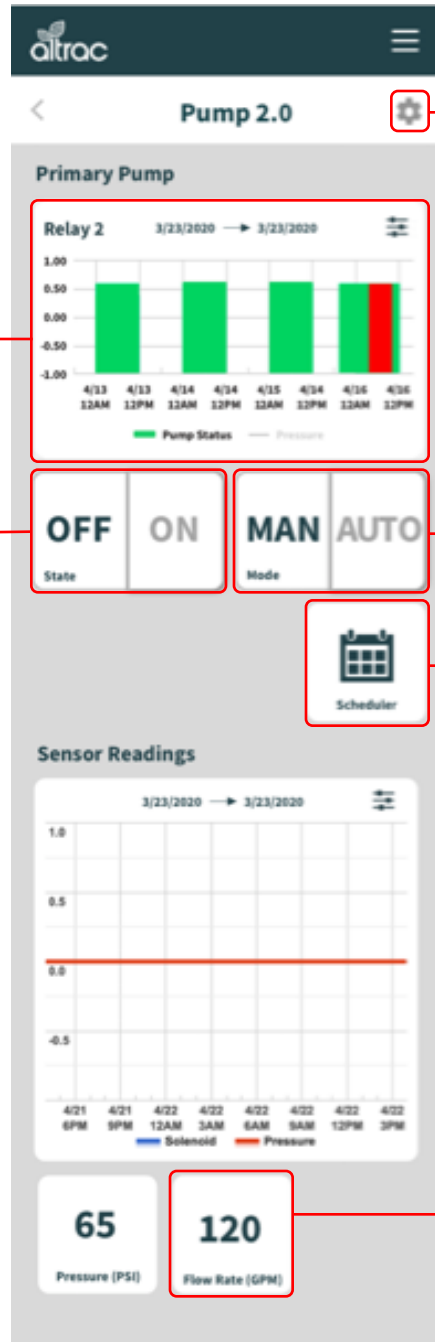
Operating Instructions - Web App

Log in to your Altrac account. To set up an account, please contact the distributor who installed your device or support@altrac.io.

Pump Operation Graph
The pump operation graph visually shows when the pump is running (green) or when the pump is off but is scheduled to run (red). You can change the default settings by clicking the settings icon in the top right.

Settings
Click the settings icon on the device page to set alerts, change device name, and update sensor settings.

State
The state tile is used to turn your equipment ON/OFF. If the tile says ON (green), your pump is running. If the tile says START (blue), your pump has been given a signal to start but is not yet at full run. If the tile says ON (red), your pump should be on, but the signal confirming the pump is running is not being returned.

Mode
The mode tile controls when the ST140 runs automatically based on a program such as a schedule or a temperature sensor for frost water.

Schedule
Use the schedule to automatically run your pump based on start and stop times.

Sensor Tile
The sensor tiles show the current sensor reading. Click on a tile to see the associated graph.

*Software packages can be upgraded at any time. If you would like to update your software package please contact support@altrac.io.

Operating Instructions - Physical Button

In order to control the ST140 in situations where you have no access to the webapp, you can use the physical button located on the device.
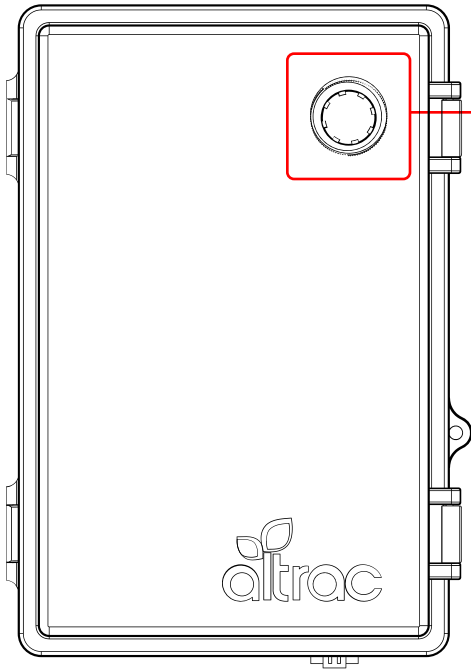
Button
Click the button once to turn ON and again to turn OFF your equipment. The button is illuminated while running.

Action	Pump 1 State	Pump 2 State	Mode	Outcome
Press < 1 second	Any	Any	Any	Device will publish telemetry to the cloud and receive queued settings.
Press > 1 second and Press < 6 seconds	Pump ON	Any	Manual	Pump 1 and 2 OFF.
Press > 1 second and Press < 6 seconds	Pump ON	Any	Automatic	Pump 1 and 2 OFF. Pump auto setting changes to manual mode.
Press > 1 second and Press < 6 seconds	Pump OFF	Any	Manual	Pump 1 ON. Pump 2 OFF. Runs until shutoff manually.
Press > 1 second and Press < 6 seconds	Pump OFF	Any	Automatic	Pump 1 ON. Pump 2 OFF. Pump auto setting changes to manual mode.
Press and Hold > 20 seconds	Any	Any	Any	Power Cycles the Cellular Modem

Error Codes

The Altrac station has the ability to check its own operation continuously. If a fault occurs, an error code will display in the webapp. Please identify the code displayed when inquiring about service.

⚠ Altrac strives to make issues fixable by anyone. However, some of the checks below may need to be completed by a qualified service technician. Call a service technician if you have any doubt or reservation about performing the remedy yourself.

Error Code Table

Error	Fault	Remedy
01	Altrac station not receiving power.	Check the power supply and wiring to the Power Terminal.
02	Altrac is not connected to the cloud.	Check that the Altrac has power. Check signal strength and quality for the device is sufficient. Check antenna cables are connected correctly to the circuit board. Move the device to gain better cellular reception. Add an external antenna for better cellular reception.
10	Relay 1 is not operating correctly. Equipment should be ON.	Check Relay 1 status LED lights up during use. Flip physical switch above Relay 1 and check for lit LED. Check wiring between Relay 1 terminal and VFD or contactors.
15	Relay 2 is not operating correctly. Equipment should be ON.	Check Relay 2 status LED lights up during use. Flip physical switch above Relay 2 and check for lit LED. Check wiring between Relay 2 terminal and VFD or contactors.
20	Relay 1 Feedback Not Received. Primary Pump should be ON.	Check Relay 1 Feedback LED is ON when equipment is ON. Check wiring between Relay 1 Feedback and VFD or current switch. Check current switch (if applicable) is dialed in correctly. Check VFD/Soft Start is programmed to close Run Signal relay when running.
21	Relay 1 Feedback is under minimum current.	Check Relay 1 Feedback LED is ON when sensor is installed. Check wiring between Relay 1 Feedback and sensor. Check calibration in the app matches sensor specifications.
22	Relay 1 Feedback is over maximum current.	Check Relay 1 Feedback LED is ON when sensor is installed. Check wiring between Relay 1 Feedback and sensor. Check calibration in the app matches sensor specifications.
23	Relay 1 Feedback is over maximum voltage.	Check Relay 1 Feedback LED is ON when sensor is installed. Check wiring between Relay 1 Feedback and sensor. Check calibration in the app matches sensor specifications.
30	Relay 2 Feedback Not Received. Secondary Pump should be ON.	Check Relay 2 Feedback LED is ON when equipment is ON. Check wiring between Relay 2 Feedback and VFD or current switch. Check current switch (if applicable) is dialed in correctly. Check VFD/Soft Start is programmed to close Run Signal relay when running.
31	Relay 2 Feedback is under minimum current.	Check Relay 2 Feedback LED is ON when sensor is installed. Check wiring between Relay 2 Feedback and VFD or current switch. Check calibration in the app matches sensor specifications.
32	Relay 2 Feedback is over maximum current.	Check Relay 2 Feedback LED is ON when sensor is installed. Check wiring between Relay 2 Feedback and VFD or current switch. Check calibration in the app matches sensor specifications.
33	Relay 2 Feedback is over maximum voltage.	Check Relay 2 Feedback LED is ON when sensor is installed. Check wiring between Relay 2 Feedback and VFD or current switch. Check calibration in the app matches sensor specifications.
40	Analog Sensor 1 is under minimum current.	Check Analog Sensor 1 LED is ON when sensor is installed. Check wiring between Analog Sensor 1 and sensor. Check calibration in the app matches sensor specifications.
41	Analog Sensor 1 is over maximum current.	Check Analog Sensor 1 LED is ON when sensor is installed. Check wiring between Analog Sensor 1 and sensor. Check calibration in the app matches sensor specifications.
42	Analog Sensor 1 is over maximum voltage.	Check Analog Sensor 1 LED is ON when sensor is installed. Check wiring between Analog Sensor 1 and sensor. Check calibration in the app matches sensor specifications.
50	Analog Sensor 2 (Accessory Port) is under minimum current.	Check Analog Sensor 2 (Accessory Port) LED is ON when sensor is installed. Check wiring between Analog Sensor 2 (Accessory Port) and sensor. Check calibration in the app matches sensor specifications.
51	Analog Sensor 2 (Accessory Port) is over maximum current.	Check Analog Sensor 2 (Accessory Port) LED is ON when sensor is installed. Check wiring between Analog Sensor 2 (Accessory Port) and sensor. Check calibration in the app matches sensor specifications.
52	Analog Sensor 2 (Accessory Port) is over maximum voltage.	Check Analog Sensor 2 (Accessory Port) LED is ON when sensor is installed. Check wiring between Analog Sensor 2 (Accessory Port) and sensor. Check calibration in the app matches sensor specifications.
70	Switch is in OFF position and pump is scheduled to be ON.	Check that the HOA swich on the pump station is in the Auto position. Check wiring between Digital Input 1 and the HOA switch.

Connectivity

The Altrac station includes a cellular modem with an embedded SIM card. Altrac negotiates with cellular networks to achieve a low price and bundle data into the cost of the device.

Altrac equipment in the United States uses LTE CATM1 (5G) networks. 2G/3G options are available upon request for other countries. The Altrac modem will automatically pick the strongest signal for its connection.

Update Frequency
Pump OFF: 10 minutes.
Pump ON: 5 minutes or less.
Pump Setting Changes from Webapp: Up to 60 seconds.

Zone 1 Networks

Country	Model	Carriers	2G Sunset	3G Sunset	5G Sunset
United States	ST100_3G	AT&T	2016-12-31	2021-12-31	
	ST100_3G	T-Mobile (USA)	2020-12-31		
	ST100_5G	AT&T			
Canada	ST100_3G	Rogers AT&T Wireless	2020-12-31	2025-12-31	
	ST100_5G	Rogers Wireless			
	ST100_5G	Telus			
	ST100_5G	Bell Mobility			
Mexico	ST100_3G	Telefonica Moviles Mexico	2019-12-31		
	ST100_5G	AT&T			
Australia	ST100_3G	Telstra MobileNet	2016-12-31	2024-06-30	

Zone 3 Networks

Country	Carriers	Model	2G Sunset	3G Sunset
United Kingdom	Telefonica O2 UK	ST100_3G		
Afghanistan	Roshan (TDAC)	ST100_3G		
Algeria	Mobilis	ST100_3G		
Argentina	Movistar Argentina	ST100_3G		
Aruba	Setar	ST100_3G		
Austria	T-Mobile Austria	ST100_3G		
Azerbaijan	Azercell	ST100_3G		
Bahrain	Batelco	ST100_3G	No Plan	No Plan
Bangladesh	GrameenPhone	ST100_3G		
Belarus	Velcom (Mobilkom)	ST100_3G		
Belgium	Base (KPN)	ST100_3G		
Bolivia	NuevaTel (Viva)	ST100_3G		
Bosnia and Herzegovina	BH Telecom	ST100_3G		
Botswana	Mascom Wireless	ST100_3G		
Brazil	Vivo	ST100_3G		
Bulgaria	Vivacom (Vivatel)	ST100_3G		
Cabo Verde	T+ Telecomunicações	ST100_3G		
Cameroon	MTN Cameroon	ST100_3G		
Chile	Movistar Chile	ST100_3G		
China	China Mobile	ST100_3G	No Plan	2020-01-01
Colombia	Colombia Telefonica	ST100_3G		
Congo (Brazzaville)	MTN Congo	ST100_3G		
Costa Rica	Telefonica Costa Rica	ST100_3G		
Côte d'Ivoire	MTN Cote d'Ivoire	ST100_3G		
Croatia	VipNet (Mobilkom)	ST100_3G		
Cyprus	Cytamobile-Vodafone	ST100_3G		
Czechia	Telefonica (O2) Czech Republic	ST100_3G		
Denmark	Telenor AS	ST100_3G		2021-12-31
Ecuador	Otecel S.A. Ecuador	ST100_3G		
Egypt	MobiNil	ST100_3G		
El Salvador	Telefonica Moviles El Salvador	ST100_3G		
Estonia	TeleTwo Estonia	ST100_3G		
eSwatini	MTN Swaziland	ST100_3G		
Finland	TeliaSonera Finland	ST100_3G		
France	Bouygues Telecom France	ST100_3G		
Gabon	Airtel (Zain) Gabon	ST100_3G		
Georgia	Geocell Georgia	ST100_3G		
Germany	Telefonica O2 Germany	ST100_3G		
	Telekom Deutschland GmbH	ST100_3G	2020-12-31	2020-12-31
Ghana	Vodafone Ghana (ONEtouch)	ST100_3G		
Greece	Wind Hellas	ST100_3G		
Greenland	Tele Greenland	ST100_3G		
Guatemala	Telefonica Moviles Guatemala	ST100_3G		
Guinea	GNBSB-Spacetel MTN Guinea Bissau	ST100_3G		
Guyana	Digicel Guyana	ST100_3G		
Hong Kong	CSL Ltd	ST100_3G		
	HKT	ST100_3G		
Hungary	Telenor Hungary	ST100_3G		2020?
Iceland	Siminn (On-Waves)	ST100_3G		
Indonesia	Telkomsel Indonesia	ST100_3G		
Ireland	H3G Ireland	ST100_3G		
	O2 Ireland	ST100_3G		
Israel	Partner Communication Israel	ST100_3G		
Italy	Wind Italy	ST100_3G		
	Hutchison 3G Italy	ST100_3G		
Jamaica	Digicel Caribbean	ST100_3G		
Japan	NTT DoCoMo	ST100_3G		Late 2020s
Jersey	Jersey Telecoms UK	ST100_3G		
Kazakhstan	K-Cell Kazakhstan	ST100_3G		
Kenya	Celtel Kenia Ltd	ST100_3G		
Kuwait	Watanya Telecom Kuwait	ST100_3G		

Country	Carriers	Model	2G Sunset	3G Sunset
Latvia	TELE2 Latvia	ST100_3G		
Liechtenstein	Mobilkom Liechtenstein	ST100_3G		
Lithuania	TELE2, Lithuania	ST100_3G		
Luxembourg	TANGO Mobile SA	ST100_3G		
Macao	CTM Macau	ST100_3G	2015-06-30	
Macedonia	T-Mobile Macedonia	ST100_3G		
Madagascar	Celtel Madagascar	ST100_3G		
Malaysia	Digi Telecom Malaysia	ST100_3G		
Malta	Go Mobile Malta	ST100_3G		
Moldova, Republ	Orange Moldova	ST100_3G		
Mongolia	Unitel Mongolia	ST100_3G		
Montenegro	Telenor Montenegro	ST100_3G		2020?
Montserrat	Cable & Wireless Montserrat	ST100_3G		
Morocco	Medi Telecom	ST100_3G		
Mozambique	Vodacom Mozambique	ST100_3G		
Netherlands	KPN B.V.	ST100_3G		2022-01-01
Netherlands Antil	Digicel Curacao	ST100_3G		
New Zealand	Spark New Zealand	ST100_3G	2012-07-31	No Plan
Nicaragua	Telefonia Celular de Nicaragua	ST100_3G		
Niger	Celtel Niger S.A.	ST100_3G		
Nigeria	Celtel Nigeria	ST100_3G		
Norway	Telia Sonera Norge	ST100_3G		2019-01-01
Oman	Omantel	ST100_3G		
Pakistan	Mobilink Pakistan	ST100_3G		
Panama	Telefonica Moviles Panama S.A.	ST100_3G		
Peru	Telefonica Moviles Peru	ST100_3G		
Philippines	Globe Telecom Philippines	ST100_3G		
Poland	Polkomtel Poland	ST100_3G		
Portugal	TMN Portugal	ST100_3G		
Qatar	Q-TEL Qartar	ST100_3G		
Réunion	Reunión-Mayotte-SRR-MTM-Societe Reunionnaise du Radio	ST100_3G		
Romania	Orange Romania SA	ST100_3G		
Russia	Vimpelcom (Beeline)	ST100_3G		
Rwanda	MTN RwandaCell	ST100_3G		
Saint Kitts and N	Cable & Wireless St Kitts & Nevis	ST100_3G		
Saudi Arabia	Al Jawal	ST100_3G		
Serbia	Telenor Serbia	ST100_3G		2020?
Seychelles	Airtel (Seychelles)	ST100_3G		
Singapore	StarHub Mobile Pte Ltd.	ST100_3G		
Slovakia	Telefonica O2 Slovakia	ST100_3G		
Slovenia	Si.Mobil Slovenja	ST100_3G		
South Africa	Cell C (PTY) Ltd.	ST100_3G		
South Korea	SK Telecom	ST100_3G		
Spain	Telefonica Moviles España	ST100_3G		
Sri Lanka	Dialog Telekom Ltd	ST100_3G		
Suriname	Digicel Suriname	ST100_3G		
Sweden	Telenor Sverige AB	ST100_3G		2020-12-31
Switzerland	Sunrise	ST100_3G	2018-12-31	2024-12-31
Taiwan	Taiwan Mobile Co., Ltd.	ST100_3G	2017-06-30	2017-01-07
Tanzania	Celtel Tanzania Ltd.	ST100_3G		
Thailand	Total Access Communic.Thailand	ST100_3G		
Trinidad and Tob	Telecom.Trinidad and Tobago Lim.	ST100_3G		
Tunisia	Orange Tunisie	ST100_3G		
Turkey	AVEA Iletisim Hizmetleri A.S.	ST100_3G		
Uganda	MTN Uganda	ST100_3G		
Ukraine	Kyivstar Ukraine	ST100_3G		
United Arab Emir	du - Emirates I.T.C.	ST100_3G		
United Kingdom	Telefonica O2 UK	ST100_3G		
Uruguay	Movistar Uruguay	ST100_3G		
Venezuela	Telefonica Moviles Venezuela	ST100_3G		
Vietnam	Viettel Mobile	ST100_3G		

Cellular Modem

Each ST140 includes a cellular modem. The modem automatically connects to the cellular network when the device has power. You may see the following states below.

The cellular modem is located on the top right of the circuit board. The modem is removeable in case of damage or obsolesence. To remove, detach the antenna by gently pulling up on the gold u.Fl antenna connector. Without exterting pressure on the top of the modem, pull up on the sides to remove the modem from its headers.
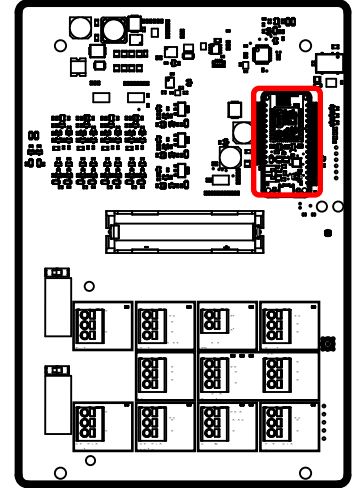
Standard Modes

The states below are the normal sequence you will see on startup.

Looking for Internet
If your device is blinking green, it is trying to connect to the cellular tower.
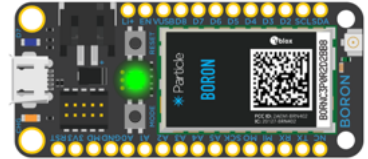
Connecting to the Cloud
When the device is in the process of connecting to the cloud, it will rapidly blink cyan. You often see this mode when you first connect your device to a network, after it has just blinked green.
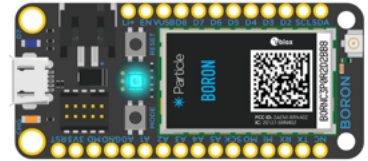
Connected
When it is breathing cyan, your device has successfully connected to the Internet.
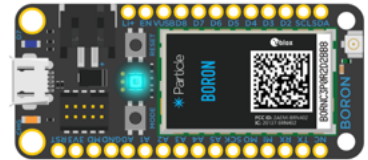
Troubleshooting Modes

Cloud Not Connected
When your device is connected to cellular but not to the cloud, the LED will breath green.
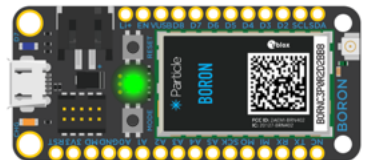
If you see the above state or any other color, please contact support@altrac.io

⚠️ The modem is the most sensitive part of the ST140. Removing the antenna connector or modem without the proper tools could void your warranty. Contact Altrac. We're happy to help.

Internal Antenna

The ST140 has an antenna mounted inside the enclosure. Because of this, mounting location of the ST140 can affect cellular signal strength. You can check the cellular signal health of your device by navigating to the settings tab in your Altrac account.

Signal Strength
Cellular signal strength of the device. Lower numbers are better.
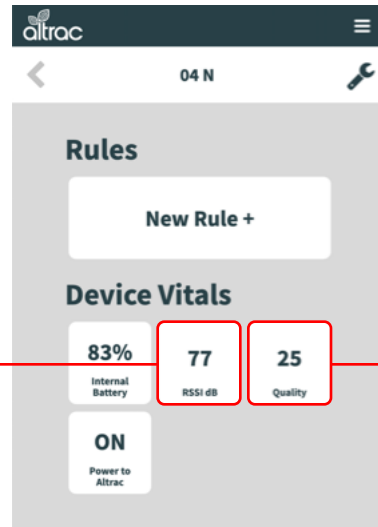
Quality
Cellular signal quality. Higher numbers are better.

Signal Strength
RSSI stands for 'Relative Signal Strength Indicator'. Any reading under 100 is acceptable and should not have trouble connecting. Anything over about 105 RSSI will be unstable with weather / congestion variances.

Signal Quality
Typically a quality of 0 means noise levels are high enough to not have a connection. A quality value of 49 is a solid noise free connection. In some scenarios a device will have a good RSSI reading, and bad signal quality reading; in this case you may need an external antenna (CN102).

Mounting Location
• As high above the ground as practical.
• In an area clear of vegetation.
• Orient the right or left side of the ST140 to face the cellular tower.

Troubleshooting Cellular Signal

• Rotate your device 90 degrees (keep connectors facing the ground). Often, the internal antenna picks up signal better in certain orientations.
• Metal weakens cellular signals. If possible keep the device away from metal, or if signal is weak, change location of the device to the opposite side of a metal cabinet.
• Add an external antenna to the device.

External Antenna

If you have followed the troubleshooting tips on the previous page and still have weak signal, you likely need an external antenna to boost the cellular signal strength. The antenna comes with two components: the antenna and the connector. Contact your distributor or sales@altrac.io to purchase the antenna.

**External Antenna**   **N-Type to SMA Connector**

Installation
You will need to install the N-type connector to the bottom of the ST140.
Step 1: Remove the plug from one of the pre-drilled holes on the bottom of the ST140 enclosure.
Step 2: Use the nut to attach the N-type connector (large silver side) to the enclosure.
Step 3: Remove the existing internal antenna SMA connector (smaller and gold side)
Step 4: Attach the new SMA connector to the mating SMA part on the circuit board.
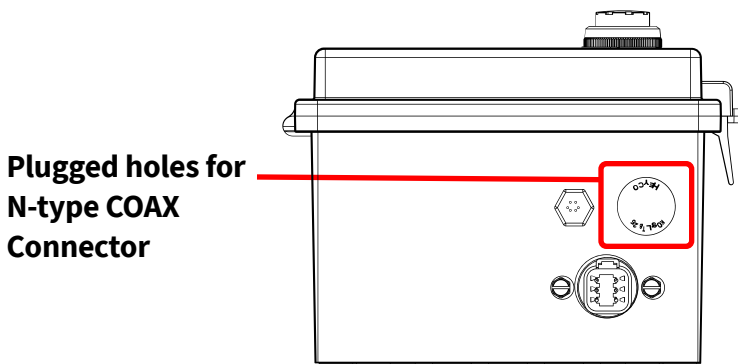
Plugged holes for N-type COAX Connector
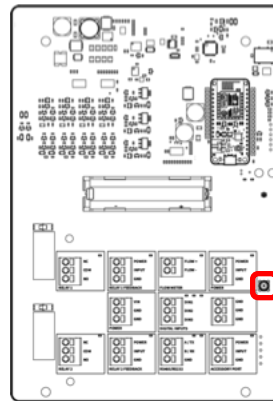
SMA Connector

Mounting
• As high above the ground as practical.
• Above any metal sheeting or cabinet.
• In an area clear of vegetation.

Default Input/Output Settings

Name	Input/Output	Default Use	Default Parameters
Power	VIN GND GND (EARTH)	Provides power to the ST140 Pump Station	15VDC
Relay 1	NC COM NO	Signal to start primary pump (irrigation pump)	Contact Ratings: 6A, 250VAC Open Relay = Pump OFF Closed Relay = Pump ON
Relay 1 Feedback	POWER INPUT GND	Run Signal provided by primary pump	Sensor Power: 15mA @ 12.5V Sensor Range: On/Off Equipment OFF: Open Circuit Equipment ON: Closed Circuit
Relay 2	NC COM NO	Signal to start secondary pump (fertigation, etc.)	Contact Ratings: 6A, 250VAC Open Relay = Pump OFF Closed Relay = Pump ON
Relay 2 Feedback	POWER INPUT GND	Run Signal provided by secondary pump	Sensor Power: 15mA @ 12.5V Sensor Range: On/Off Equipment OFF: Open Circuit Equipment ON: Closed Circuit
Analog Input 1	POWER INPUT GND	Pressure Transducer (Pre-filter)	Sensor Power: 0-30mA @ VIN Sensor Type: 4-20mA Sensor Range: 0-25mA Sensor Range: 0-100PSI
Accessory Port	POWER INPUT GND	Pressure Transducer (Post-filter)	Sensor Power: Off Sensor Type: 4-20mA Sensor Range: 0-25mA Sensor Range: 0-100PSI
Flow Meter	Flow + Flow -	Flow Meter Pulse Monitor	Isolated Pullup 10mA @ 12VDC 1 pulse = 100 gallons
Digital Input 1	DIN1 GND	HOA Switch Location	Sensor Power: VIN @ 12mA Sensor Type: Digital Input Equipment OFF: 0V Equipment ON: VIN
Digital Input 2	DIN2 GND	None	Sensor Power: VIN @ 12mA Sensor Type: Digital Input Equipment OFF: 0V Equipment ON: VIN
Digital Input 3	DIN3 GND	None	Sensor Power: VIN @ 12mA Sensor Type: Digital Input Equipment OFF: 0V Equipment ON: VIN
RS485/RS232	A / TX B / RX GND	VFD Monitoring	Contact support@altrac.io

Dimensions and Components

7.892"
200.47mm

11.292"
286.82mm

5.591"
142mm

6.233"
158.31mm

0.079"
2mm
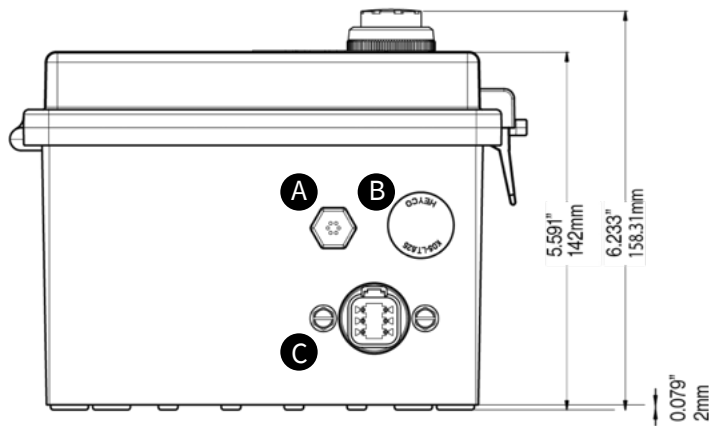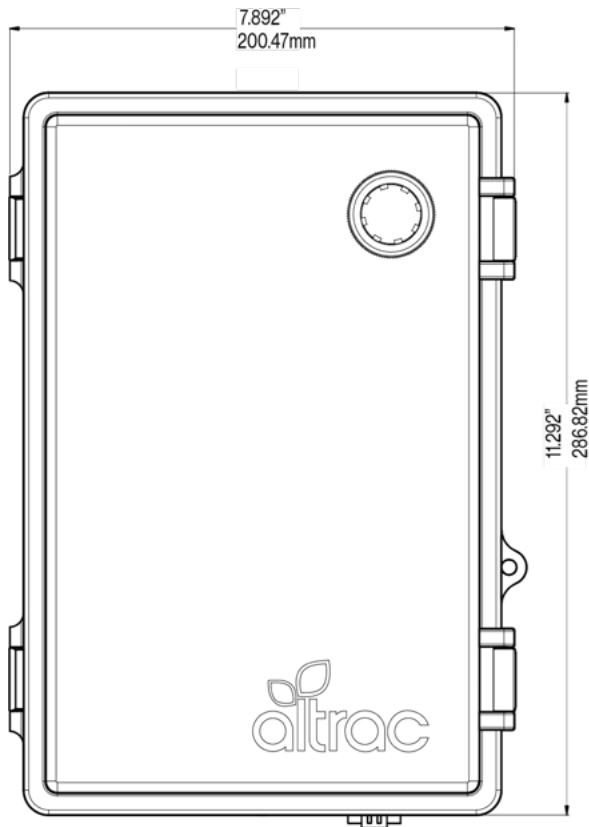
Components

A: Waterresistent Vent
B: Plug on .6" hole, PG9 Cable Gland
C: Accessory Port, 6-Pin, APT

Additional Components Shipped but Not Installed on Enclosure

PG13.5 Cable Gland (1)
PG9 Cable Gland (2)
Wall Mounting Brackets (4)
M5 x 10mm Lg. Truss Hd. Machine Screws (4)

Power Supply

We recommend powering the ST140 with a 15VDC power source. The Altrac provided option is described below.

Pump Station (ST140) Specifications:
Power Supply Voltage: 12-15VDC
Power Consumption: 2A peak usage

Power Supply Specifications:
Altrac Part Number: PW200
Input Voltage: 100-240VAC
Output Voltage: 15VDC
Current: 4A
Wattage: 60W
Weatherproofing: IP67
Wire length: 12' (3.6m)
Mounting Method: Brackets on body of power supply.

Installation:
Wire the power supply conductors to the terminals in the 'Power' section.
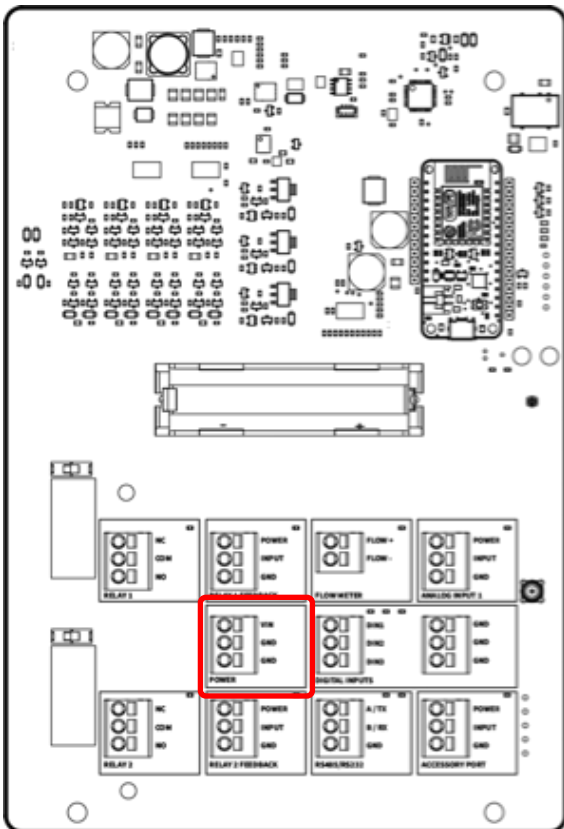
Wiring
VIN: Power +
GND: Power -
GND: Earth Ground

Backup Battery

The ST140 includes a backup battery designed to power the device for up to 3 hours during a power outtage. This battery will not allow the pump to continue operating, but it does allow the ST140 to notify the user when their pump has lost power. The battery is not required for operation.

Specifications:
Altrac Part Number: PW200
Battery Type: Lithium Ion Cell
Battery Size: 18650
Continuous Discharge Rating: >= 3A
Nominal Voltage: 3.6v
Nominal Capacity: >= 2000mAh
Rechargeable: Yes

⚠ Protection Circuit: Mandatory. If you do not use a battery with an integrated PCB protection circuit, the warranty on the ST140 is void.

Installation:
During setup you must remove the plastic strip protecting the battery terminal of the button.

Removal:
To remove the battery, pull on the ribbon behind the battery.
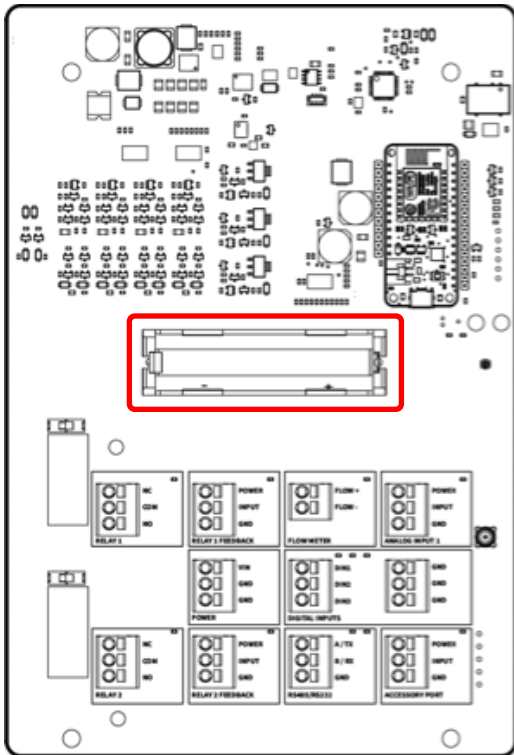
Relays

The ST140 has 2 onboard relays for controlling a primary and secondary pump. The relays are controlled independantly through the Altrac webapp or physically through the 'test switches' on the PCB.

Relay Specifications
Contact Ratings: 6A, 250VAC, 85°C, Cycles: 30x10^3
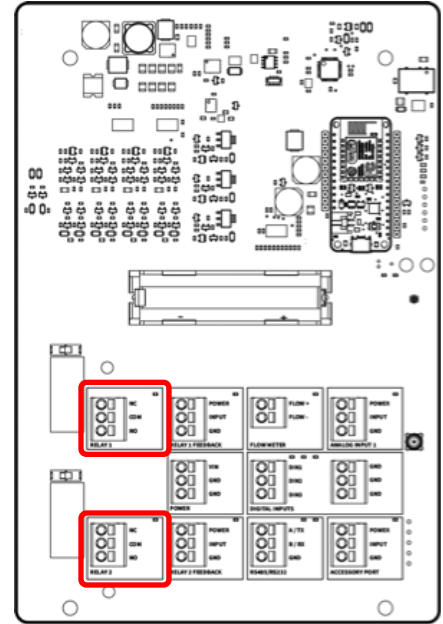Approvals: VDE Cert. No. 40023970, UL E214025, CQC 12002066685

Wiring
NC: Normally Closed
COM: Common
NO: Normally Open

Operation
The relays have a 60 second timeout between cycles to protect against damage to equipment.

Installation

Setup A: VFD or Soft Start Driven Pump
VFD and Soft Start ("inverter") driven pumps are typically controlled by a 2-wire circuit. Wire 1 is connected to the inverter's common terminal (typically labeled "COM", "SN" or "+24V"); Wire 2 is connected to the inverter's control input terminal (typically labeled "S1", "DIN1"). When the two wires are connected, typically with a Hand-Off-Auto switch, the inverter will engage the pump; when the wires are disconnected the inverter will disengage the pump.

To install the ST140 in with an inverter wired for 2-wire control, use Relay 1 COM and NO to "break" the signal between Wire 2 HOA switch and Wire 2 inverter control input terminal. When installed, the operator will be able to turn the pump on only when the "HOA" switch is in the auto position and the ST140 is set to run the pump.

If an inverter is setup for 3-wire control (an "Off" button and an "On" button) or other forms of control, we recommend having your electrician convert your inverter to 2-wire control before installation.

Setup B: Contactor or Relay Driven Pump
Using Relay 1, you can control a secondary relay or contactor rated for the pump's amperage and voltage. DO NOT use the ST140 to directly drive a pump. In typical contactor installations, a contactor is driven by a switch or by a relay then a switch. The switch is turned on by the operator; the switch turns on a relay ("drive relay"), which then turns on a contactor, which feeds power to the pump.

To install the ST140 in the above scenario, you would "break" the wire coming from the switch to drive relay with the Relay 1 NO and COM terminals.

Relays - Testing

To test the relay functionality without access to the Altrac webapp, you can open the enclosure and check the relay status LEDs or physically switch the relays ON/OFF. When not testing, the relay switch should be in the left 'OFF' postition.

Relay 1 Switch
Relay 1 Status LED

Relay 2 Switch
Relay 2 Status LED
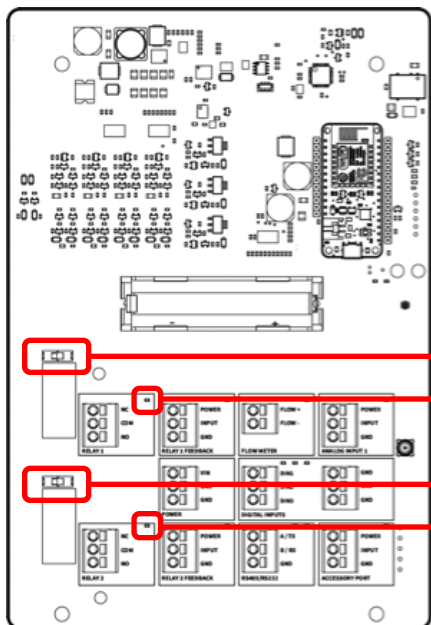
Relay Switches

Relay 1 and 2 each have a physical switch. The switch is located directly above the relay on the circuit board. When the switch is ON, the relay and assocaited LED will also turn ON. If the relay is already ON, the switch will not affect the relay.

Relay Status LEDs

Relay 1 and relay 2 each have a status LED. The LED in the top right corner of each relay terminal section turns ON (RED) when the relay is ON.

Test via Webapp

You can also test the relays by turning the equipment ON/OFF through the Altrac webapp. Click the State tile to 'ON' to turn the equipment ON. It may take up to 10 minutes for the ST140 to download the instructions and switch the relay.
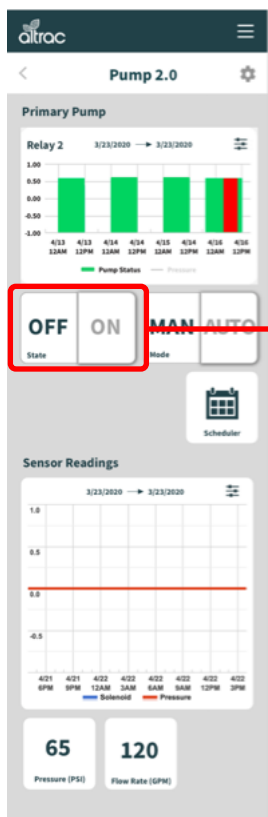
Relay Feedback Input

In order to monitor the status of the equipment, the Pump Station needs a signal when the pump is running. This signal tells our device when the pump is ON or OFF.

Wiring
POWER: Supply power to sensor COM
INPUT: Signal return from sensor output
GND: Not Used

Default Input Specifications:

Sensor Power: 15mA @ 12.5V
Sensor Range: On/Off
Equipment OFF: Open Circuit
Equipment ON: Closed Circuit

Alternate Input Specifications:

Sensor Power: 30mA @ VIN
Sensor Range: 4-20mA or 0-10VDC
Equipment OFF: >= 5mA or > 5V
Equipment ON: < 5mA or < 5V

*Contact Altrac Support for customization

Installation

Setup A: VFD or Soft Start
VFD and Soft Start ("inverter") devices have internal relays that can be programmed to close or open when the motor is running. Connect "POWER" to COM and "INPUT" to NO on the relay chosen for this task.

For Yaskawa iQ1000 inverters, we recommend connecting to relay M1-M2 and to change the chosen relay's parameter to close on event "During Run".

For Danfoss VLT inverters, we recommend connecting to relay 1 and to change the chosen relay's parameter to close on event "VLT Running".

Contact support@altrac.io for other inverter support.

Setup B: Pump Contactor
If your pump is contactor or relay driven, or you do not want to use your inverter's relays, a current switch (Altrac part number SN300) can be used to determine when the pump is running.

The current switch is installed on one of the wires ("legs") sending power to the motor. You must remove the leg then pass it through the current switch. Connect ST140 "POWER" to COM and "INPUT" to NO on the current switch. The current switch may need adjustment to provide the proper run signal. Refer to the current switch user manual.

Current Switch
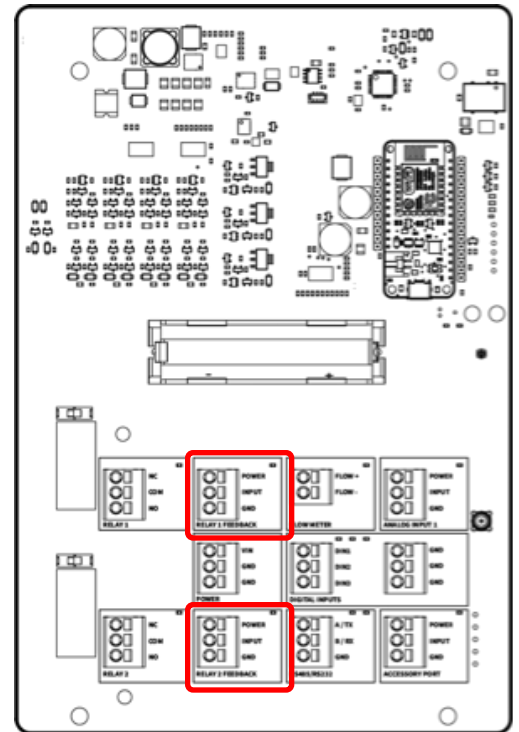
Analog Sensors

There are two analog sensors inputs on the ST140 Pump Station. These inputs are commonly used to monitor pressure sensors such as transducers (PSI reading) or switches (ON/OFF).

Default Input Specifications for Analog Input 1 and Accessory Port:

The analog inputs by default are setup for pressure transducers with the following characteristics. To change the settings, refer to Analog Sensor Adjustment instructions on the next page.

Power: VIN @ 30mA
Current Range: 4-20mA
PSI Range of Transducer: 0-100PSI

Pressure Transducer (SN210): 4-20mA Output

Wiring
POWER: RED, V+
INPUT: Black, Output
GND: Shield Drain Wire

Shielded Cable Models Wire Designation		
Wire Color	0 - 10 VDC Output	4 - 20 mA Output
Red	V +	V +
Black	Com	Output
White	Output	None
Bare*	Shield Drain Wire	Shield Drain Wire

* Where shielded wiring is being used; Connect the drain wire to the guard terminal on the read out device or measuring instrument if available. In all other cases connect to the power supply negative terminal.

Pressure Switch (24VDC Max)

Wiring
POWER: RED, V+
INPUT: Black, Output
GND: Shield Drain Wire (when applicable)

Analog Input Settings

To change the Analog Input Settings, navigate to your ST140's settings page in the Altrac webapp. Instructions are on the next page (page 23).
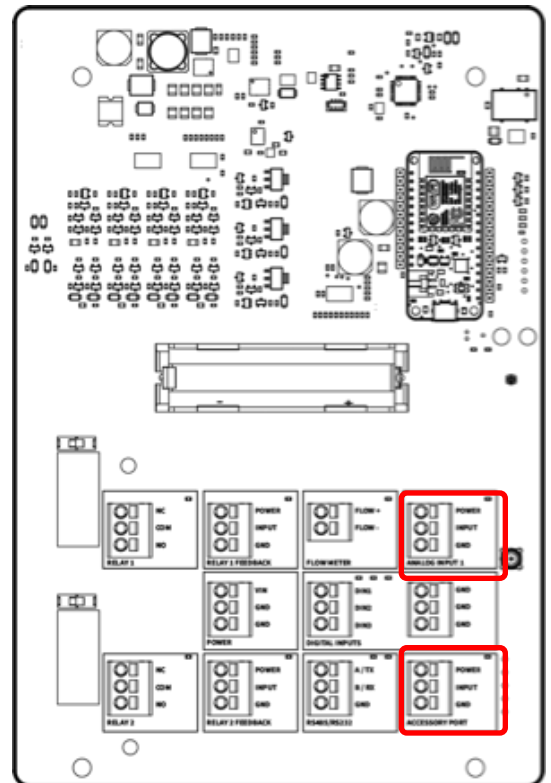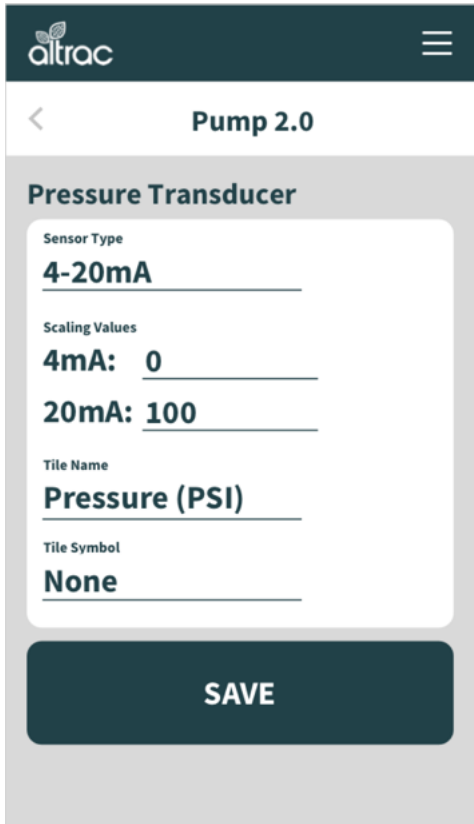
Analog Sensor Adjustment

If you need to adjust the default settings for the Analog Sensors, you must do so through the webapp.

Webapp Navigation:

Navigate to the ST140 device in question. Click on the gear icon in the top right corner of the device page to access the settings page. Click on the appropriate sensor tile to change settings.

Flow Meter

The flow meter input accepts a pulse output from most flow meters such as McCrometer or Seametrics. Refer to your flow meter user manual to confirm pulse output capability.

Wiring

(1) Connect the 'Pulse +' wire from your flow meter to the 'Pulse +' terminal on the ST140.

(2) Connect the 'Pulse -' wire from your flow meter to the 'Pulse -' on the ST140.

Installation

To protect the wiring, we recommend running the wires through PVC conduit. If you use PVC conduit, a junction box near the flow meter makes troubleshooting much easier.

Calibration

The default calibration for the Altrac is 100 gallons per pulse. Most flow meters do not emit a pulse by default. You will need to check your flow meter settings to determine the gallons per pulse value. Some flow meters require a magnet to adjust settings.

If you need to use a pulse value that is not 100 gallons per pulse, adjust the calibration through the Altrac webapp sensor adjustment page.

Pulse Frequency

Ideal pulse frequency is not more than 1 pulse per second and not less than 1 pulse per 2 minutes while water is flowing

Maximum Pulse Frequency: 50 pulses per second

Minimum Pulse Frequency: If your pulse signal is infrequent (1 pulse per 10 minutes), flow rate will not be accurate.

Accuracy

Pulse Output: ±5% of total pulses sent by flow meter. Flow meter errors not included.
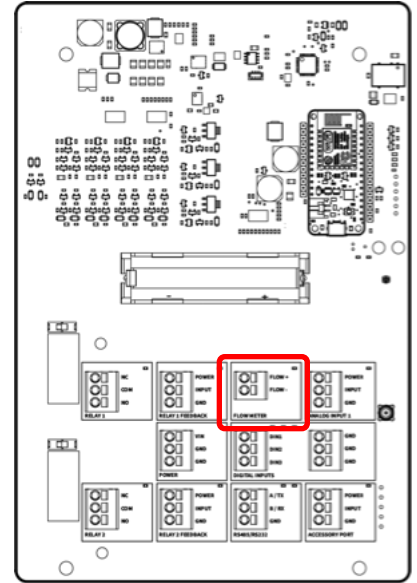
Digital Inputs

The digital inputs on the ST140 are used for monitoring switches and simple sensors.

Default Input Specifications for Digital Inputs:
DIN1: HOA Switch Auto Position
DIN2: Not Defined
DIN3: Not Defined
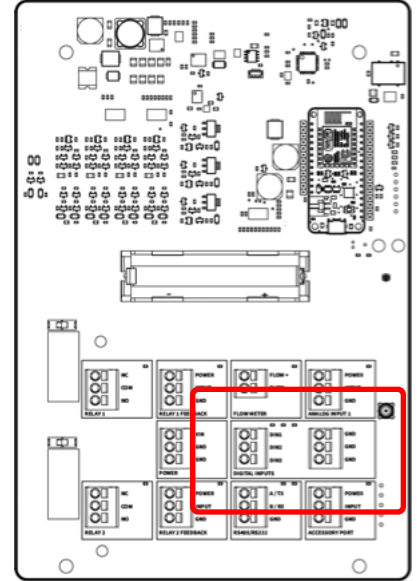
Power: VIN Pull Up
ON Threshold: Closed Contact (0V)
OFF Threshold: Open Contact (VIN)

HOA Switch Wiring
See page 28, Hand-Off-Auto Instructions.

Adjusting Digital Input Usage
No adjustment necessary.

RS485/RS232

RS485/RS232 is an industrial digital communication protocol. It is frequently used for two or more devices to communicate and share information. The ST140 uses RS485/RS232 to communicate with various controllers such as VFDs and Soft Starts.

Wiring

(1) Connect the 'RS485 A' input on the controller to RS485 'A' terminal on the ST140.
(2) Connect the 'RS485 B' input on the controller to RS485 'B' terminal on the ST140.
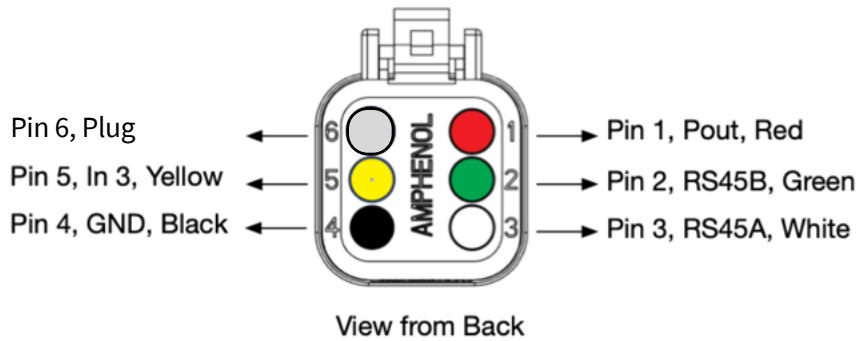(3) Connect the 'GND' input on the controller to 'GND' terminal on the ST140.

Communication Settings

(1) You will need to update settings on your controller to enable RS485 communication.
(2) Contact Altrac to learn more about which controllers are supported.
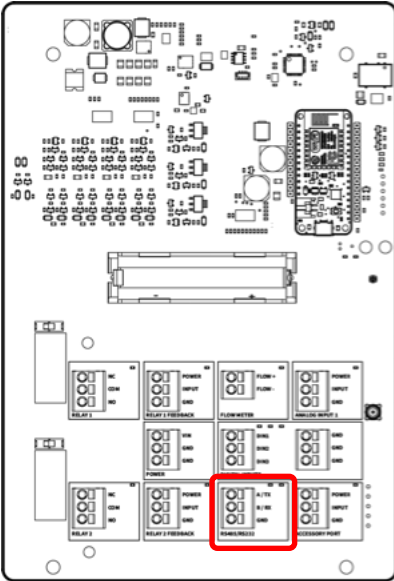
Accessory Port

The accessory port on the bottom of the ST140 allows for easy installation of additional sensors. Sensors include temperature sensors, soil moisture sensors, and others. Contact Altrac to learn more about new sensor options.

Pin 6, Plug

Pin 5, In 3, Yellow

Pin 4, GND, Black

AMPHENOL

Pin 1, Pout, Red

Pin 2, RS45B, Green

Pin 3, RS45A, White

View from Back

⚠ Connecting non-supported sensors to the accessory port may cause damage to the ST140. Please contact support@altrac.io to ensure your sensor is safe.

Hand-Off-Auto Detection Instructions

The ST140 detects the position of the HOA switch in order to tell users when the pump is in Auto mode and the ST140 can control the pump.

WARNING: Use an empty terminal block on the HOA switch to provide the signal to the ST140. If you wire the HOA detection into an in-use terminal you will mix electrical signals and receive unpredictable results.

1) Determine if the HOA switch has a free terminal block for Auto detection. In an existing installation, the HOA switch will have wires connected to both its Hand and Auto terminals used to turn the pump on and off in both Hand and Auto modes.

IMPORTANT: If there are no free terminals, you will need to add a stacking contact block to the auto side of the HOA switch. Do not wire into a used contact block.

2) Follow connections diagram "HOA.1" below to wire the ST140 Digital Input to detect Auto position

ST140 DIN1 Terminal connect to HOA Auto NO
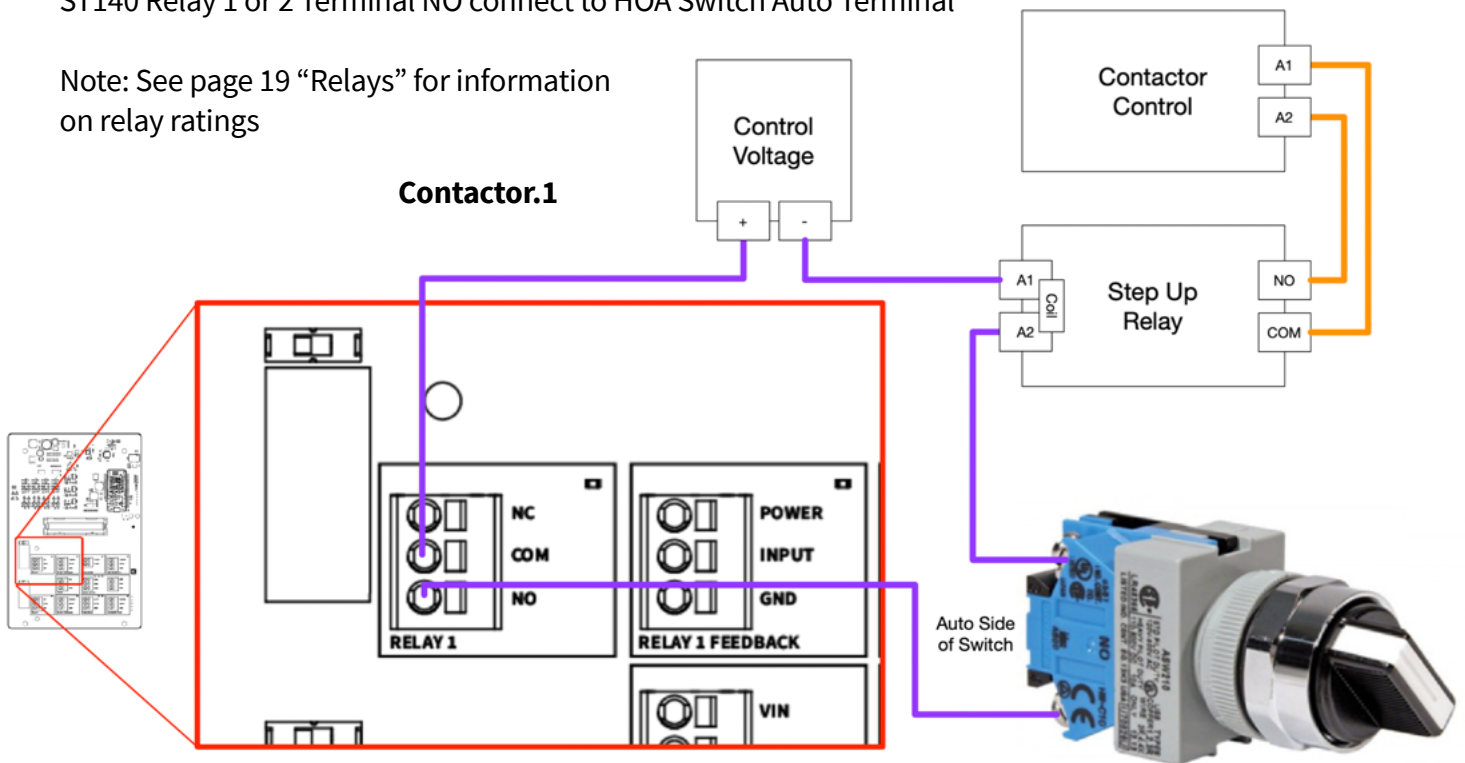ST140 GND Terminal connect to HOA Auto COM
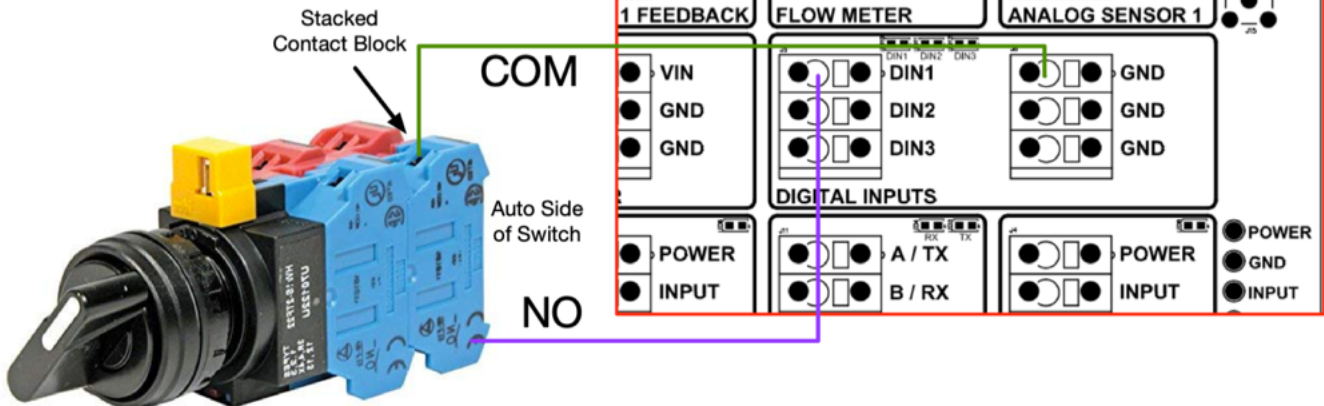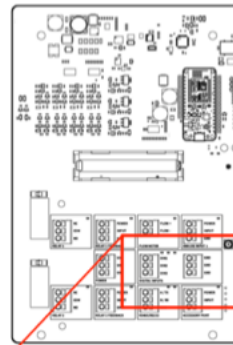
Contactor - Controlling the Contactor

The ST140 sends control signal via its mechanical relays, Relay 1 and Relay 2. The contacts COM/NO/NC are "dry" and so act similarly to a Hand-Off-Auto switch.

1) The Contactor must be wired to turn on and off via a Hand-Off-Auto switch where the Auto side of the switch controls the pump directly, i.e. when the switch is turned to Auto, the pump starts immediately and without any additional button presses.

2) Follow connections diagram "Contactor.1" below to wire the ST140 relay to control the Contactor. The diagram is a general diagram and should not be followed exactly, as each pump installation is different.

ST140 Relay 1 or 2 Terminal COM connect to Control Voltage
ST140 Relay 1 or 2 Terminal NO connect to HOA Switch Auto Terminal

Note: See page 19 "Relays" for information on relay ratings

Contactor.1

Receiving Run Signal From Contactor

See page 21 "Setup B" for information on using a current switch to determine when a contactor is on and powering a motor

For full manuals for the Inverter above, please visit:
https://altrac.zendesk.com/hc/en-us/articles/360048825813

Fuji Frenic Eco - Controlling the VFD

The ST140 sends control signal via its mechanical relays, Relay 1 and Relay 2. The contacts COM/NO/NC are "dry" and so act similarly to a Hand-Off-Auto switch.

1) The Inverter must be set to accept run and stop commands via its control circuit terminal FWD. If you have a Hand-Off-Auto switch currently in place controlling your Inverter, it's likely the inverter is setup correctly. To double check, go to function code F02 and ensure it is set to "1: Digital Input". If this is not how the Inverter is setup, you will need to modify the inverter for this control method; for more detail see Frenic Eco manual pages 3-42 and 8-11.

2) Determine if the Inverter's control circuit is set to SINK mode (default) or SOURCE mode. See diagram "Frenic.1" below.

3) Follow connections diagram "Frenic.2" below to wire the ST140 relay to control the Inverter
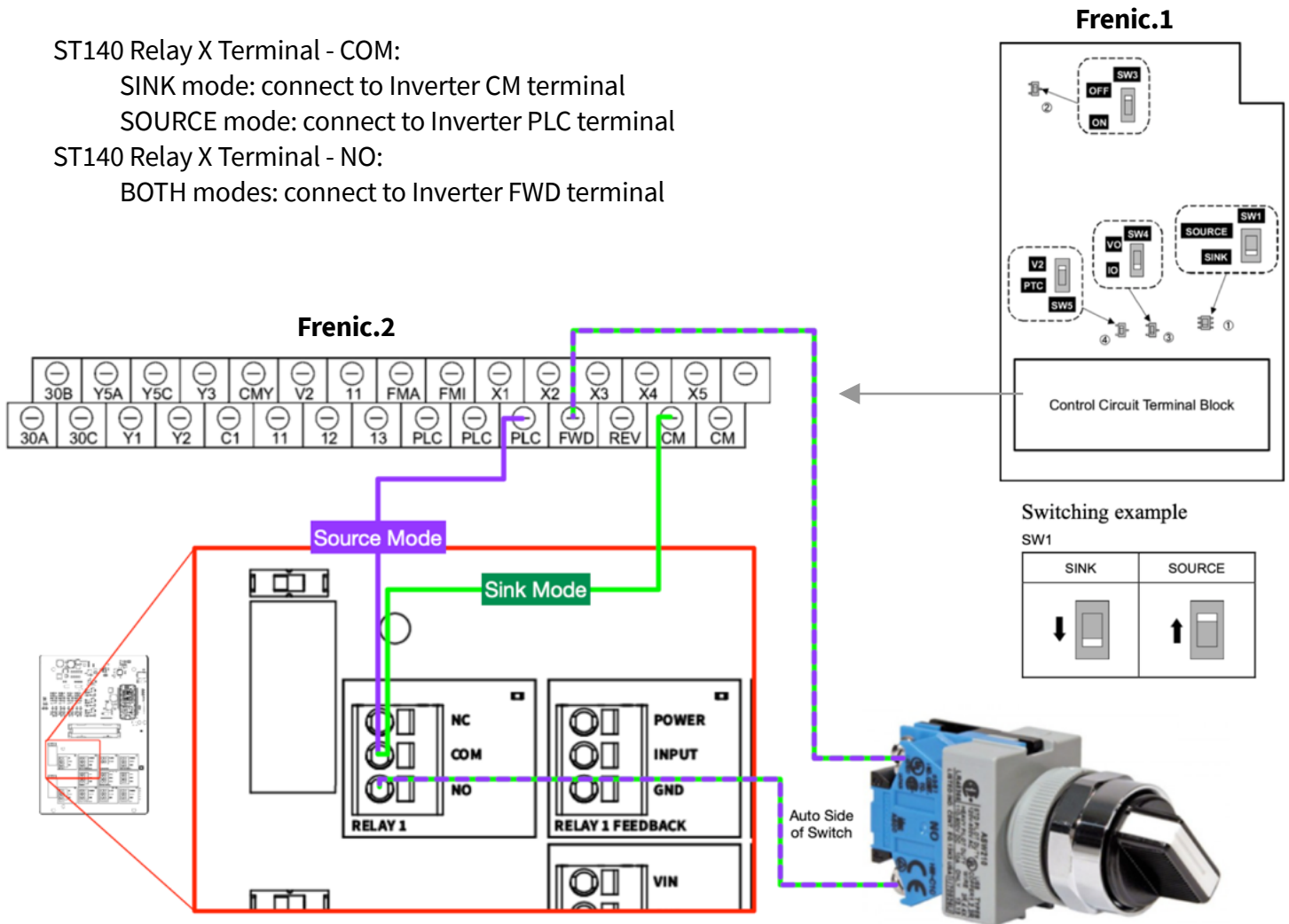
  ST140 Relay X Terminal - COM:
    SINK mode: connect to Inverter CM terminal
    SOURCE mode: connect to Inverter PLC terminal
  ST140 Relay X Terminal - NO:
    BOTH modes: connect to Inverter FWD terminal

Frenic.1

Frenic.2

For full manuals for the Inverter above, please visit:
https://altrac.zendesk.com/hc/en-us/articles/360048825813

Fuji Frenic Eco VFD - Receiving a Run Signal

WARNING: Do not connect the ST140 Relay X Feedback terminals to a run signal source that is being used by another device. Doing so is dangerous, will result in mixed electrical signals and will void the ST140 warranty.

1) The Inverter must be set energize and de-energize its Y5A/C relay according to its run state. This can be changed on the inverter by changing function code E24 to "0: Inverter Running". If Y5A/C is in use, relay 30A/B/C can be used by changing function code E27 to "0: Inverter Running". For more detail see Frenic Eco manual page 9-8.

2) Follow connections diagram "Frenic.3" below to wire the ST140 to receive run signal from the Inverter.
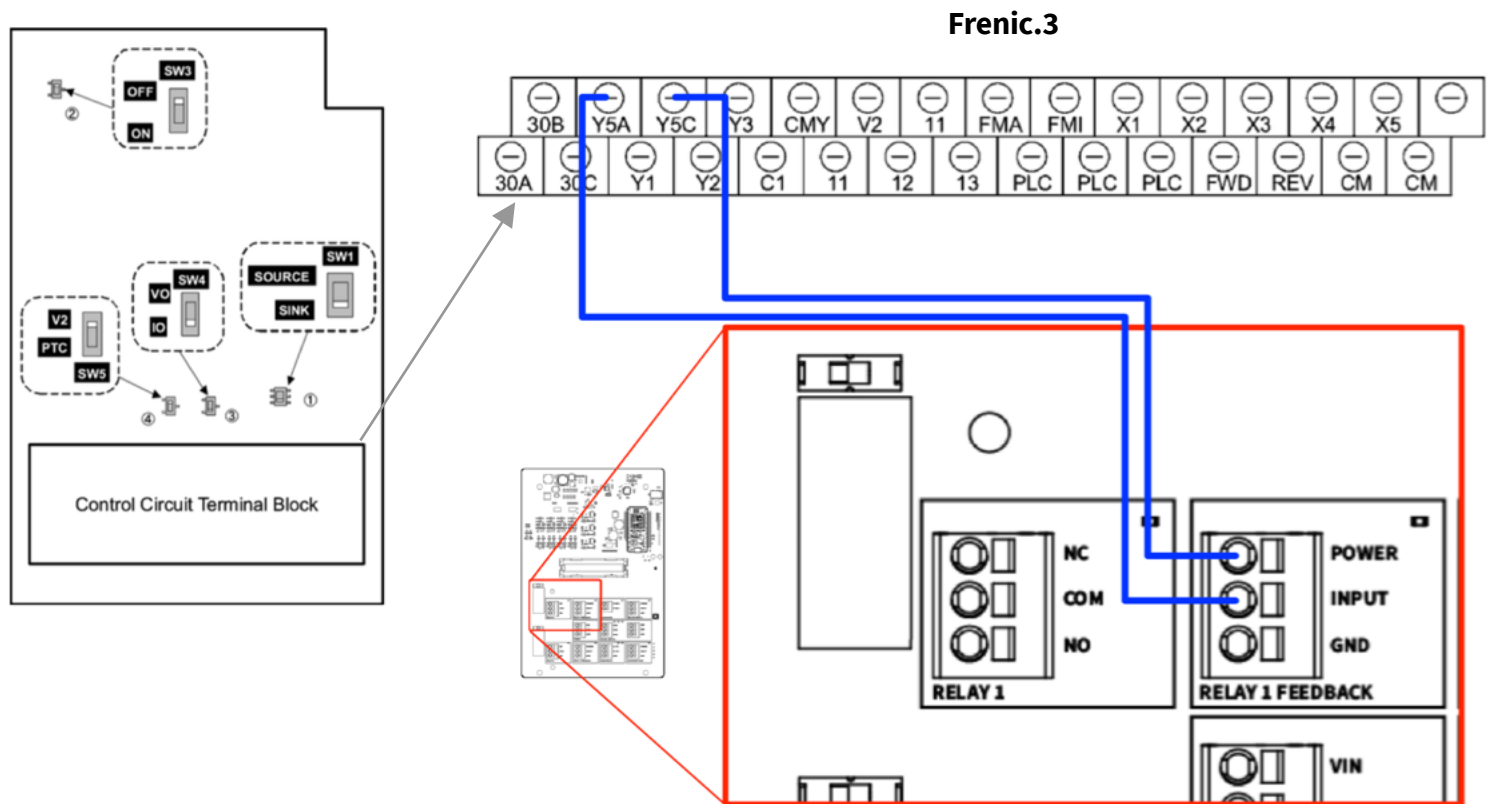
    ST140 Relay X Feedback Terminal - POWER to Inverter Control Terminal Y5C
    ST140 Relay X Feedback Terminal - INPUT to Inverter Control Terminal Y5A

If using relay 30A/B/C:

    ST140 Relay X Feedback Terminal - POWER to Inverter Control Terminal 30C
    ST140 Relay X Feedback Terminal - INPUT to Inverter Control Terminal 30A

Frenic.3

For full manuals for the Inverter above, please visit:
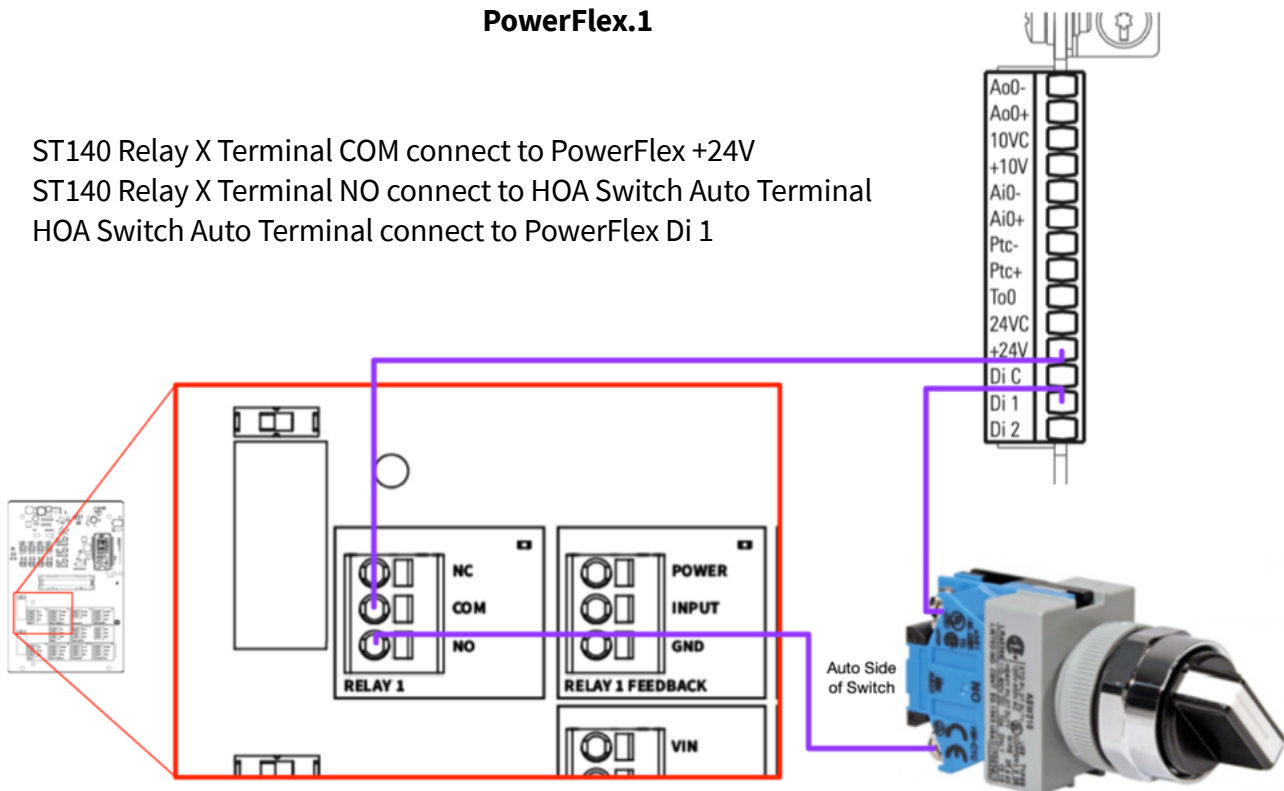https://altrac.zendesk.com/hc/en-us/articles/360048825813

Allen Bradley PowerFlex 753 - Controlling the VFD

The ST140 sends control signal via its mechanical relays, Relay 1 and Relay 2. The contacts COM/NO/NC are "dry" and so act similarly to a Hand-Off-Auto switch.

1) The Inverter must be wired for "2-Wire" control, the default for this Inverter. If you have a Hand-Off-Auto switch currently in place controlling your Inverter, it's likely the inverter is setup correctly. If this is not the case, refer to the Installation manual for proper 2-Wire control setup.

2) Follow connections diagram "PowerFlex.1" below to wire the ST140 relay to control the Inverter. Depending on your Inverter setup, you may use different terminals from PowerFlex +24V and PowerFlex Di 1

PowerFlex.1

ST140 Relay X Terminal COM connect to PowerFlex +24V
ST140 Relay X Terminal NO connect to HOA Switch Auto Terminal
HOA Switch Auto Terminal connect to PowerFlex Di 1

For full manuals for the Inverter above, please visit:
https://altrac.zendesk.com/hc/en-us/articles/360048825813

Allen Bradley PowerFlex 753 - Receiving a Run Signal

WARNING: Do not connect the ST140 Relay X Feedback terminals to a run signal source that is being used by another device. Doing so is dangerous, will result in mixed electrical signals and will void the ST140 warranty.
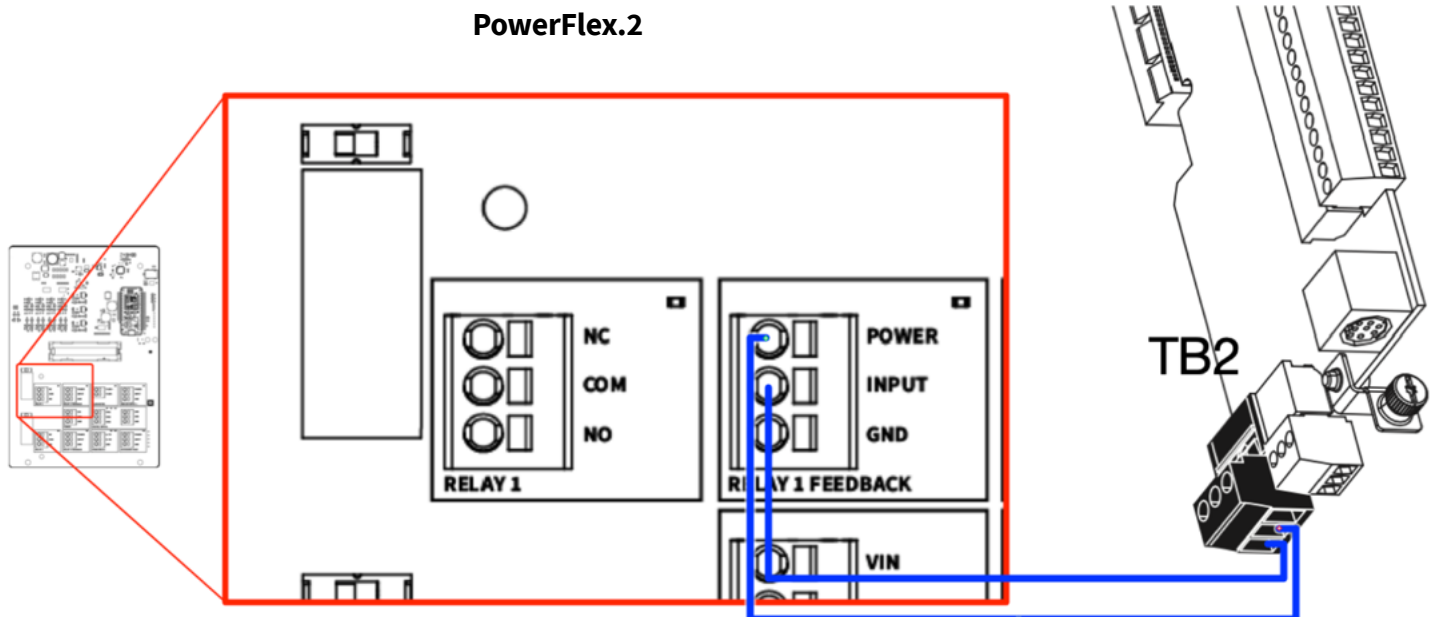
1) The Inverter must be set energize and de-energize its R0 relay according to its run state. This can be changed on the inverter by changing parameter 230 to "93516" (see page 79). The value "93516" equates to turn relay on when parameter 935 "Drive Status" bit 16 "Running" equals "1" (page 163-165).

This YouTube video is helpful for programming the PowerFlex: https://youtu.be/koVNuY_Puf4. Follow the directions, except at time 0:44 select Port 0 instead of Port 4 and at time 1:10 go to parameter 230 instead of parameter 10.

2) Find R0. Relay R0 is located on the bottom of the main control board, on terminal block TB2. See diagram PowerFlex.2 below.

3) Follow connections diagram "PowerFlex.2" to receive run signal from the Inverter.

> ST140 Relay X Feedback Terminal POWER connect to Inverter R0C
> ST140 Relay X Feedback Terminal INPUT connect to Inverter R0NO

PowerFlex.2

For full manuals for the Inverter above, please visit:
https://altrac.zendesk.com/hc/en-us/articles/360048825813

Warranty

One Year Limited Warranty

1. What is covered by this warranty
All Altrac hardware comes with a 1-year warranty from date of purchase. During the warranty period, Altrac will replace or repair, at no charge, any product or parts of product that prove defective due to improper materials or workmanship under normal use. Altrac must be notified in writing of any product defect.

2. What is not covered by this warranty
Altrac does not warrant (a) defects caused by failure to provide a suitable installation environment for the product; (b) damage caused by use of the product for purposes other than those for which it was designed; (c) damage caused by disasters such as fire, flood, and lightning; (d) any other abuse or misuse by the purchaser.

3. Disclaimer of warranty
The foregoing warranties are in lieu of all other warranties, express or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.

4. Limitation of remedies
In no event will Altrac be liable for any special, incidental, or consequential damages based on breach of warranty, breach of contract, negligence, strict liability, tort, or any other legal theory. Damages that Altrac will not be responsible for include, but are not limited to: loss of profits, loss of revenue, loss of use of the product or any associated equipment, loss or damage to crops, cost of any substitute equipment, facilities, or services, downtime, the claims of third parties including customer, and injury to property.

5. No other warranties
This statement is intended and understood to be the complete and exclusive warranty with respect to the product that is the subject of this sale and said warranty supersedes all oral or written prior agreements and all other communications between the parties relating to the subject matter of this warranty, including statements made by salespersons. No employee of Altrac or any other party is authorized to make any warranty in addition to those set forth herein.

6. Mandatory Arbitration
All disputes arising under this warranty, including those which may otherwise have been determined in a court of law, shall be submitted to and determined solely through binding arbitration as determined by Altrac.