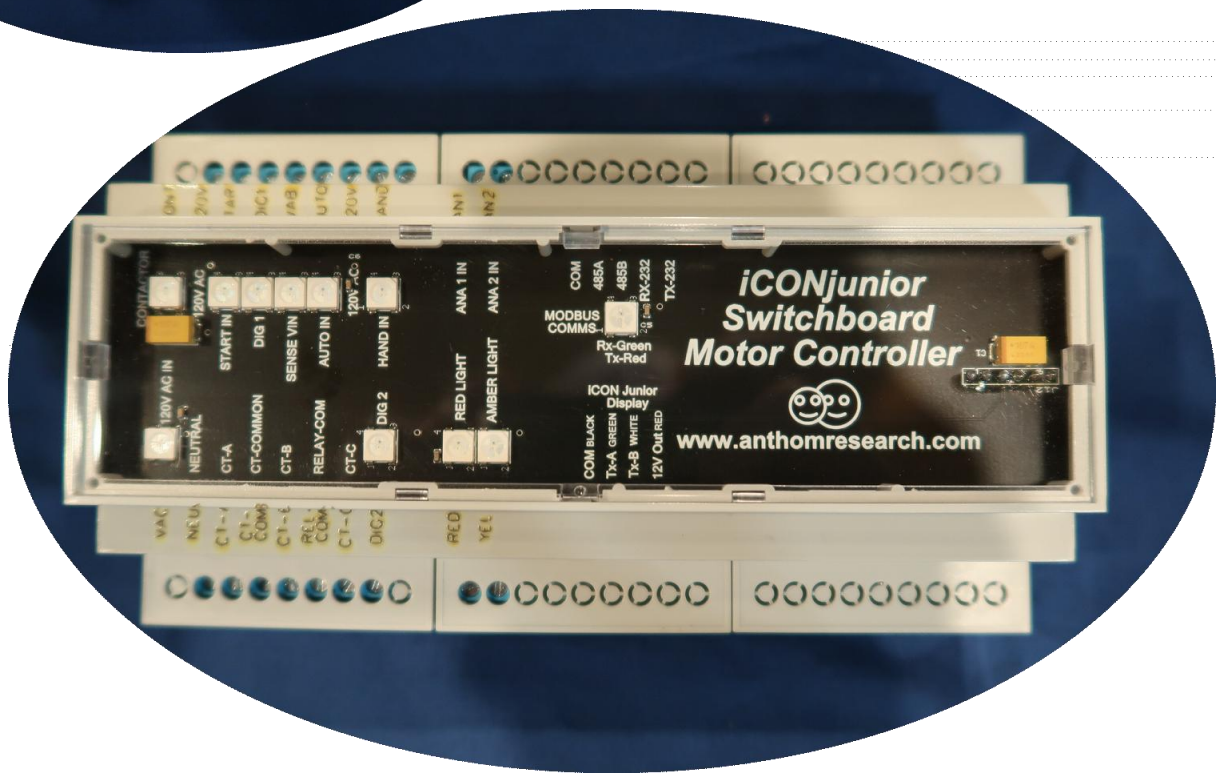
# iCON junior
# Motor Controller Manual


**Anthom Research LLC**
**Tulsa, Oklahoma**
**918-766-4628**
**www.anthomresearch.com**

Version 1.5

# Table Of Contents

# Introduction

Developed to be pin compatible with all major switchboard motor controllers, the iCON junior is a drop in upgrade for Vortex / SSMC / F1 / F3 / F5 / iCON and similar switchboard motor controllers. To make upgrades and replacements as simple as possible the iCON junior uses exactly the same connection pin out and menus as the obsolete SSMC; no digging through manuals or calling the help desk for support.

However the iCON junior adds many enhancements, since standard in the iCON junior is a built in ampchart, logging 3 currents, 3 Voltages, 2 analog inputs, digital inputs and temperature, all recorded every 10 seconds. Also stored are all historical events, such as power fails, power dips, power restored, under / over loads etc. All of the ampchart data is stored for approximately 50 years and historical data is stored forever.

The iCON junior has enhanced, modern and more reliable electronic hardware. For example, the 120 VAC internal power supply is rated up to 277 VAC rather than the older motor controllers 150 VAC to make it more robust in oil field environments subject to frequent power surges. The main control unit has status indicators for all input and output signals, plus intelligent color changing indications for rapid troubleshooting.

The display unit has all the familiar SSMC menus; however in addition to the built in SD card ampchart and event data logging it also supports connections via a WiFi network provided by the iCON junior, so an operator may download all log data and view current operating status when within a few hundred feet or so of the switchboard, without getting out of the vehicle. Local WiFi networks, internet connections, cell phone service etc. are *not* required to access the iCON junior via WiFi. Just pull out your phone and look for the iCON junior provided WiFi network.

# Specifications

## Control Unit

Size – (w x l x h) – 6.5” x 3.5” x 2.25” (base plate dimensions)

Weight – 1 pound

NEMA – NEMA 1 rated

Power – 120V AC nominal 0.5A load.

Discrete Inputs – 2 dry contact inputs, can be configured as NO or NC

Analog Inputs 2, 0-10 VDC full scale. Ananlog Input 1 has high and low set points.

CT Inputs, 3 one for each phase. CT range is 0-5 amps and should be set according to the tap point during installation to obtain correct operation.

PT Inputs, 2. PT input 1 is to pins 1 and 2 on the control unit, and monitors the Voltage between phase A and phase C. PT input 2, if used, (sometimes called the sense Voltage) connects between pins 2 and 15 to monitor the Voltage between phase A and B. If this is connected the controller can also monitor Voltage imbalance and motor direction.

Hand/Off/Auto – The control unit has inputs for manual (Hand) and auto (Auto) operational control.

Outputs – 3, Contactor, Amber indicator and Red for the front panel indicators

Output may be 120VAC or Neutral, depending on relay common configuration.

The serial communications comm port has a 5 pin connector for both RS/232 and RS/485 protocols. It has the same pin out and connections as RFScada, Viking Scada, ACE Sensor readouts and iCON motor controllers. It is fully optically isolated. Serial settings may be modified using the keypad, WiFi connection or via Modbus.

## Operator Display

Size – (w x l x h) – 4.75” x 3.625” x 1.625” (excludes mounting tabs tabs) Weight – 1 pound

NEMA – NEMA 4 rated when mounted in the Amp chart.

Power – Derives its power via the communications cable from the motor controller. Approximately 0.05A load.

Display – The display has four keypad switches and two displays. The keypad controls scrolling through the unit parameters and settings. The left display indicates which parameter is being displayed, the right display shows the current value of the parameter.

# Safety Warnings

Danger warnings – The danger warning symbol is an exclamation mark enclosed in a triangle which precedes letters spelling the word “DANGER”. The Danger warning symbol is used to indicate situations, locations and conditions that can cause serious injury or death:

**DANGER**

Caution Warnings - The caution warning symbol is an exclamation mark enclosed in a triangle which precedes letters spelling the word “CAUTION”. The Caution warning symbol is used to indicate situations and conditions that can cause operator injury and/or equipment damage:

**CAUTION**

Other warning symbols may appear along with the Danger and Caution symbol and are used to specify special hazards. These warnings describe particular areas where special care and/or procedures are required in order to prevent serious injury and possible death.

Electrical Warnings – The electrical warning symbol is a lightning bolt mark enclosed in a triangle. The electrical warning symbol is used to indicate high voltage locations and conditions that may cause serious injury or death if proper precautions are not observed:

For the purposes of this manual and product labels, a Qualified Person is one who is familiar with the installation, construction, operation and maintenance of the equipment and the hazards involved. This person must:

1. Carefully read and understand the entire manual.
2. Be trained and authorized to safely energize, de-energize, clear faults, ground, lockout and tag circuits and equipment in accordance with established safety practices.
3. Be trained in the proper care and use of protective equipment such as safety shoes, rubber gloves, hard hats, safety glasses, face shields etc. in accordance with established safety practices.
4. Be trained in rendering first aid.

Read and follow all Warnings, Precautions, Notes, and Instructions included in this document.

**Note** **Inspect system ground and bonds prior to power application. Shock hazard could exist if proper ground is not maintained.**

# System Overview

Specific connections for the Motor Control unit as well as parameter definition and values are given in other sections of the manual. In this section, an overview will be provided as an introduction to the operation of the Motor Control unit. Reference Figure 1 in the following descriptions.

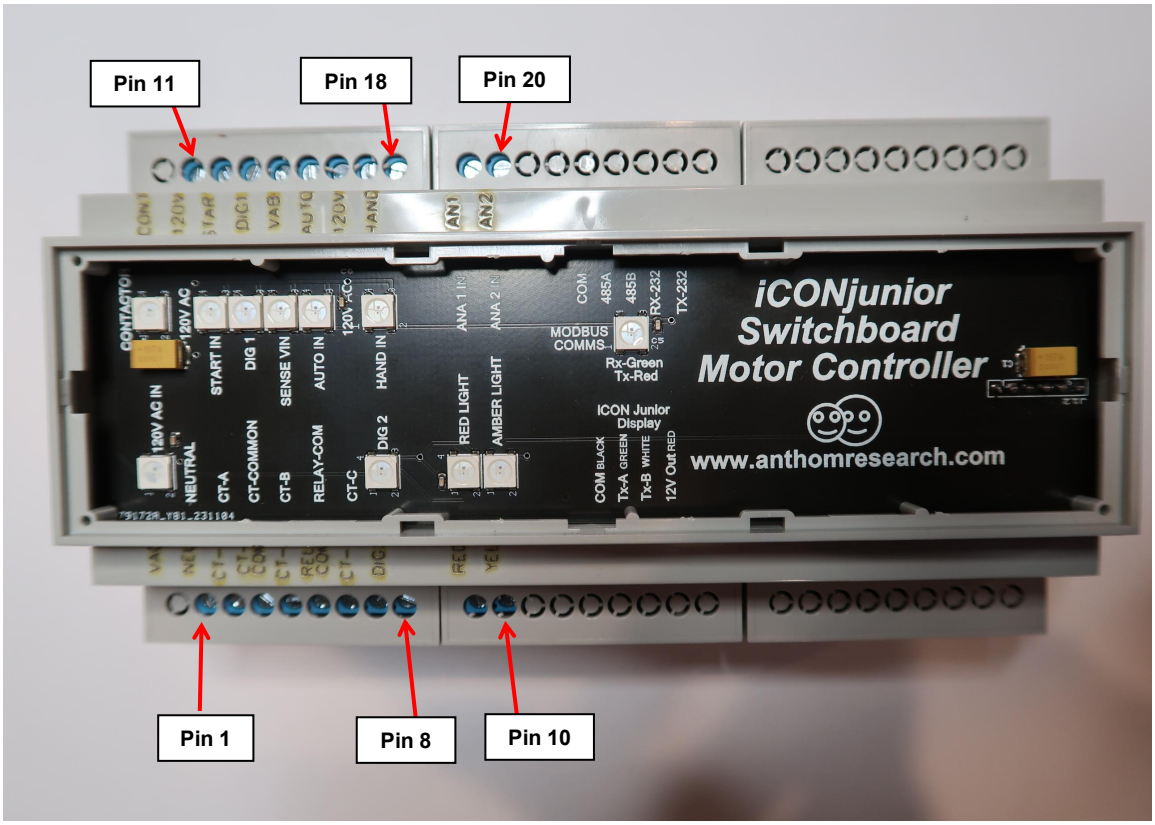



***Figure 1 – Motor Control Unit Connections***

**Pins 1 and 2** – These two pins are connected to the Power Transformer (PT), and provide the voltage between Phase A and Phase C of the motor input power. The voltage is expected to be 120 VAC, and achieves this value through tap settings on the PT. The 120V AC IN LED will normally be green if the input is correct; the LED will be different colors if there are error conditions (see motor controller LED indicators for further explanation). Care must be taken to ensure the correct PT tap is set to prevent possible damage to the motor controller.

**Pins 3, 4, 5, and 7** – These pins are associated with the Current Transformers (CT). Pins 3, 5, and 7 are the inputs from the CT's associated with the three phases of current flowing to the motor. Pin 4 is the common for the three taps. The CT's are all 0-5 amp range, and must have the proper tap setting to provide the correct sensing and check values during system operation. The tap setting should be the lowest that will permit the CT to maximize the amps/amp range of the input, with some allowance for over current occurrences.

In conjunction with the CT inputs, the Motor Controller has parameter set points for over and

under current sensing conditions. These provide motor shutdown signals as required for motor safe operation. There is also a start-up time delay that allows the motor to come to normal operation before the over/under sensing begins.

**Pin 6** – This pin connects to the common on the three system relays for the external red, amber and green / contactor relays. This allows the system to be wired to switchboards that may have neutral common for the three lights and contactor, or hot common for the three lights and contactor. This pin must be connected either to hot (pin 1) or neutral (pin 2) for the external lights and contactor to function. The diagram shows connection for a system with common neutral on the lights and contactor.

**Pins 12, and 17** – These pins provide AC power for use with switches, relays, or other devices requiring AC power for operation.

**Pins 8 and 14** – These are the Discrete Inputs and can be used with dry type contacts. They can be used as normally open (NO) or normally closed (NC) configured sensors, as determined by the parameter setting for each. Their use is installation requirement driven.

**Pin 9 – RED indicator**. Will normally be on for any of the following conditions:

- An alarm is active
- Last shutdown caused by alarm configured as Lockout
- Hand/Off/Auto switch is in OFF or HAND position

**Pin 10 – AMBER indicator**. Will normally be on for any of the following conditions:

- All alarms are clear
- Automatic restart will occur on delay timeout complete and H/O/A in Auto position

**Pin 11 – Contactor**. Enables motor contactor to energize, turning on motor. A green indicator may also be tied to this line for motor running indication.

**Pin 13 – Start**. Start button on the front of the switchboard. Causes the motor to start given all conditions are correct.

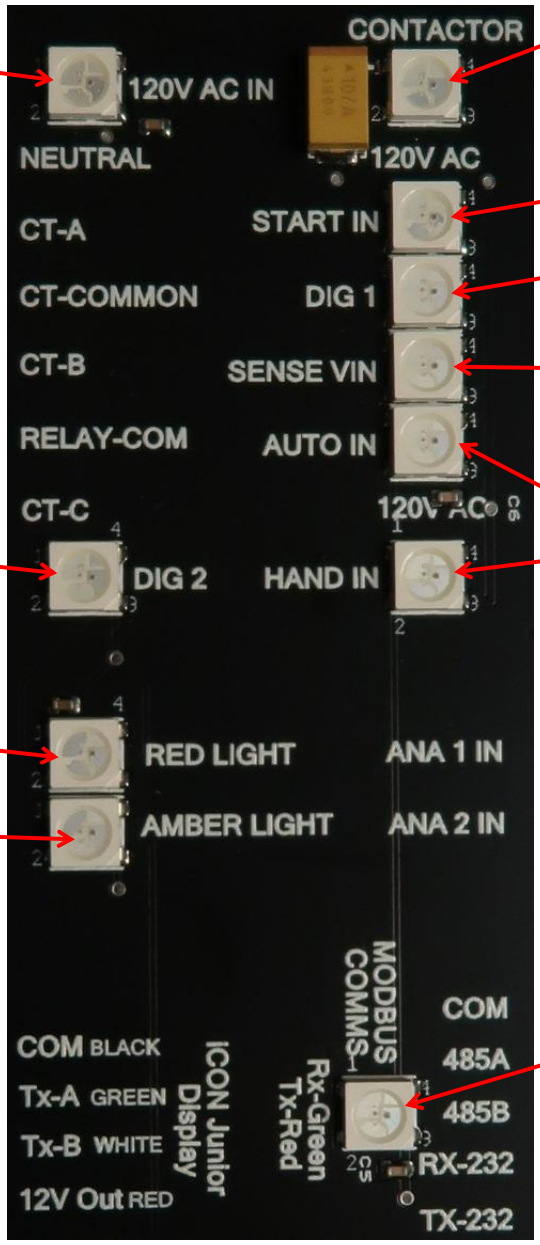
**Pin 15 – Phase AB**. Sensing input point if phase AB is to be sensed and monitored. A second PT will have to be installed for this function. The Sense Vin LED will normally be green if the input is correct; the LED will be different colors if there are error conditions (see motor controller LED indicators for further explanation). Care must be taken to ensure the correct PT tap is set to prevent possible damage to the motor controller.

**Pin 16 – Auto**. Input from AUTO position of the H/O/A switch.

**Pin 18 – Manual**. Input from HAND position of the H/O/A switch.

**Pins 19 and 20** – Analog Inputs. 0-10 V analog input control signals.

## ***Motor Controller LED Indicators***




Yellow if Voltage is < 102 VAC
Green if Voltage is > 102 VAC
Red if Voltage is > 138 VAC
Off if Voltage is < 80 VAC

Green if contactor is energized

Green when start button is pressed

Blue when DIG 1 is active (closed)

Yellow if Voltage is < 102 VAC
Green if Voltage is > 102 VAC
Red if Voltage is > 138 VAC
Off if Voltage is < 80 VAC

Blue when in Auto mode

Blue when DIG 2 is active (closed)

Blue when in Hand mode

Red when red indicator is active

Amber when amber light is active

Red when transmitting data
Green when receiving data

## Operator Display


The operator display unit can be either a permanently installed piece of equipment, or plugged in as desired to check and/or set system operating parameters. The unit is plugged into the iCON junior port using the supplied interface cable. The ESC key permits the operator to cancel any selection, enter allows the selection to be modified. The parameter list display is a two- digit display, while the value display is a four-digit display. Once the selection is made, the UP and DOWN arrow keys permit the operator to increase the displayed value (UP) or decrease the value (DOWN) to arrive at the desired parameter or set point. Once the desired point is reached, the ENT (Enter) key can be pressed to enter the data into the motor controller memory.

Typical operation would be to select ESC and then UP or DOWN to arrive at the parameter of interest. The selection would be followed by UP or DOWN to arrive at the value required for operation of that parameter. The operator would then depress ENT to save the value into memory. The parameters and range of value is given in the section covering parameter setting.

# Installation

## DANGER

The Motor Control unit derives its power from the Power Transformer (PT), which is connected to the high voltage lines into the switchboard. High voltages are present during operation and set-up, and should be considered hazardous.

### Control Unit

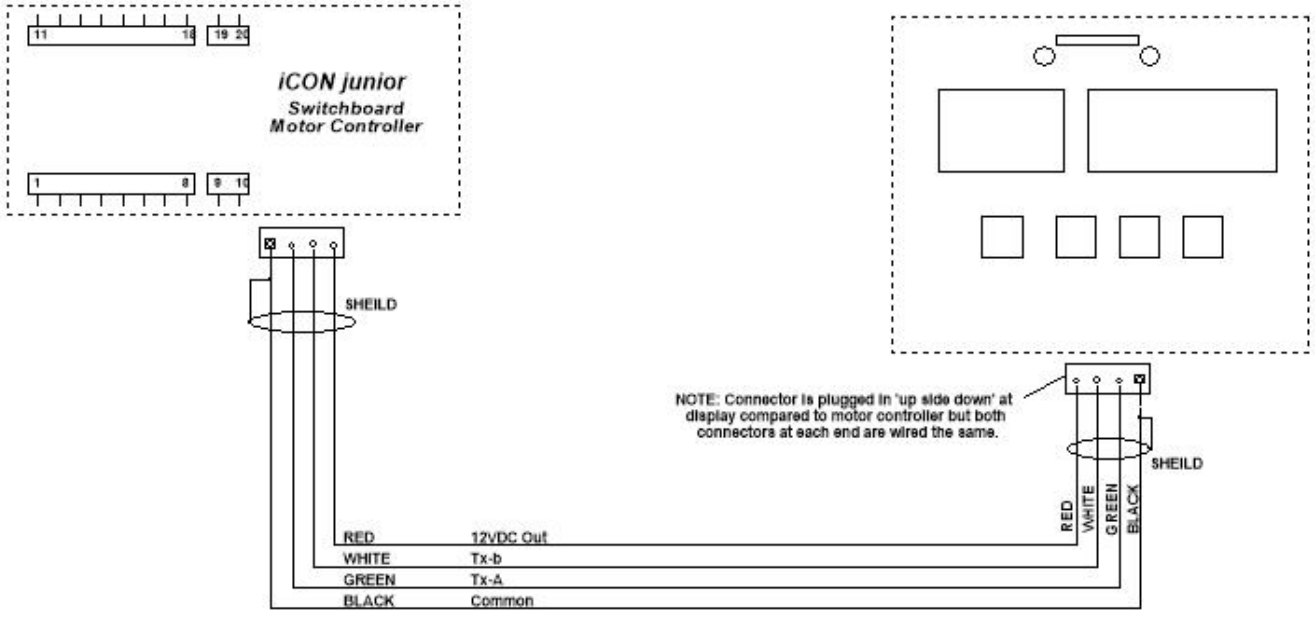
The Motor Controller is extremely easy to install. A typical wiring diagram is included in the appendix. The settings required for the parameter list must be determined prior to turning on the unit, and must be entered prior to attempting to operate the downhole unit.

Any fault that cannot be cleared must be resolved before continuing in the operation. Faults should not be bypassed or over ridden without explicit understanding of the underlying reasons for the fault.

### Operator Display

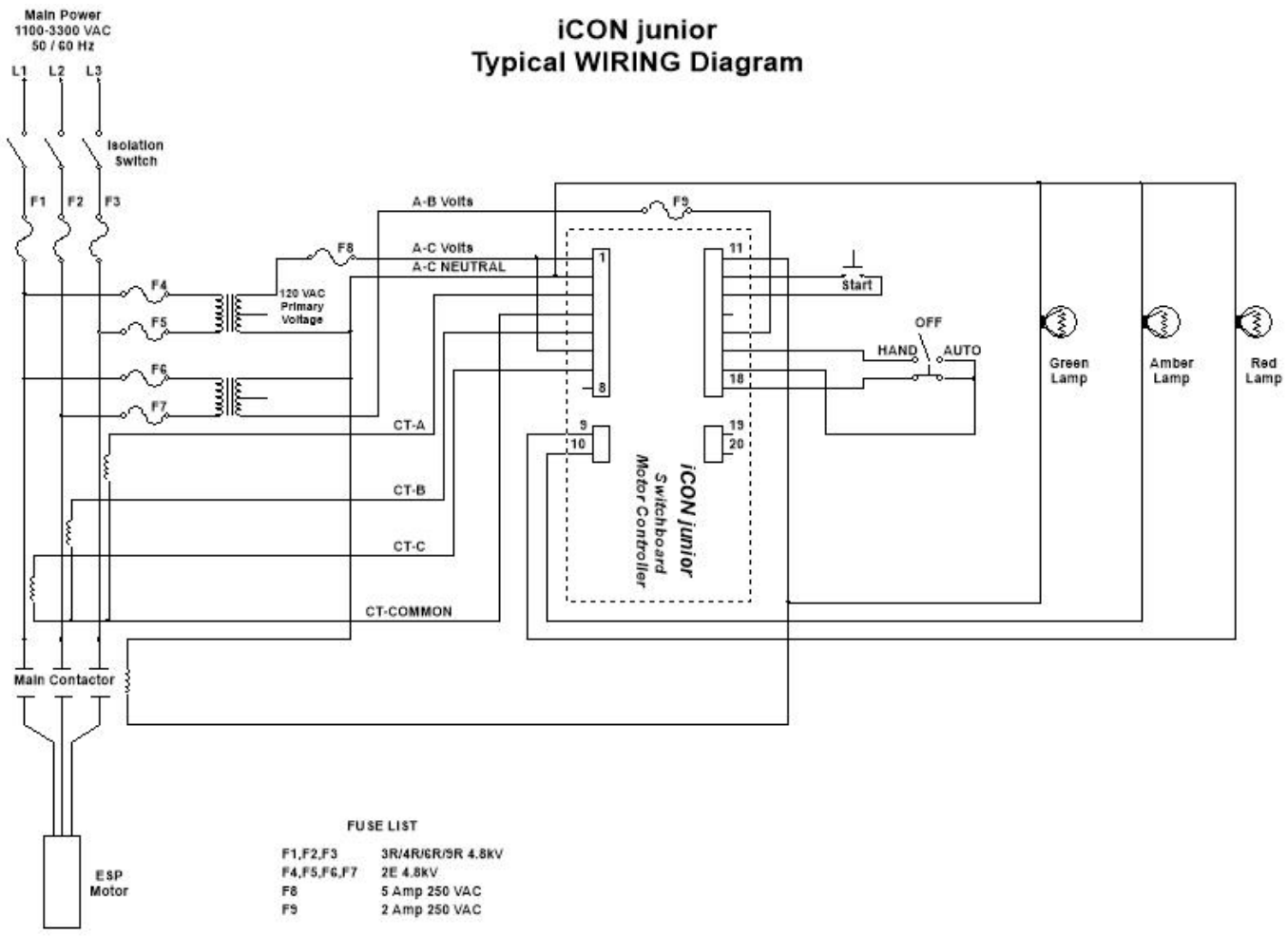
The Operator Interface can be mounted inside the ammeter enclosure using the two screws supplied. There are no special connections required for the Operator Display.

**iCON junior**
**Controller to Display Wiring**




**Cable assembly P/N 3002020-001 (10 ft. length)**

## ***Figure 3 – Typical Connection***



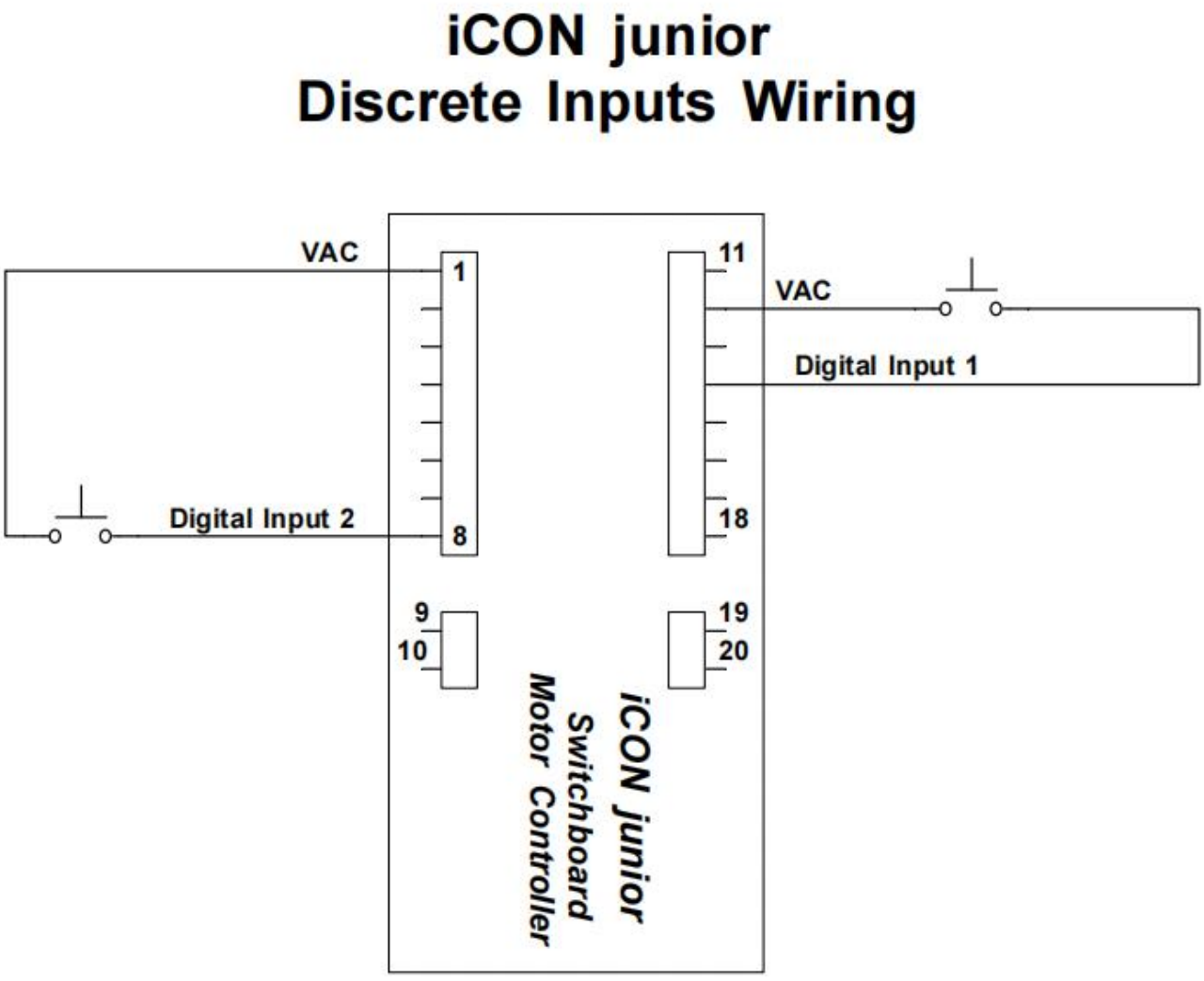
# Discrete Inputs

The iCON junior has two discrete inputs. These can be utilized for dry contact remote shutdowns. The discrete inputs can be configured for either N/O or N/C operations via software parameter list. Parameter list covering this operation is:

**Di-1 ~ 44**
**Di-2 ~ 46**

The iCON junior parameter list default setting is N/O. An example of setup is illustrated below:

***Figure 5 – Typical Connection***



In the example, parameter list #44 is set to N/O and parameter list #46 is set to N/C. If the input to Di-1 is high, the motor controller will time out (the preset time value in parameter list #59) and shutdown. If the input to Di-2 is low, the motor controller will wait the preset time (parameter list #62) and shutdown. This is an example of N/O versus N/C configuration.

As mentioned above, there are ‘shutdown’ timers for each Di input. These are determining factors in how long the motor controller will operate the equipment in alarm status. Additionally, there are two other Di fault handling timers. There are identified as parameter list #58, and parameter list #60. For Di-1 and Di-2 respectfully, the purpose of these timers is to allow the equipment to reach normal operating status after start-up. It must be noted on startup that both timers are cumulative. The ‘shutdown’ timer will not initiate its timing function until the ‘delay on start timer’ has reached its preset value.

Parameters #45 and #47 designate restart capability with active alarm on respective Di. Since the ‘delay on start timers’ minimum value is 1 second, this parameter has been added to give the user greater control over restart and fault handling of the Di’s.

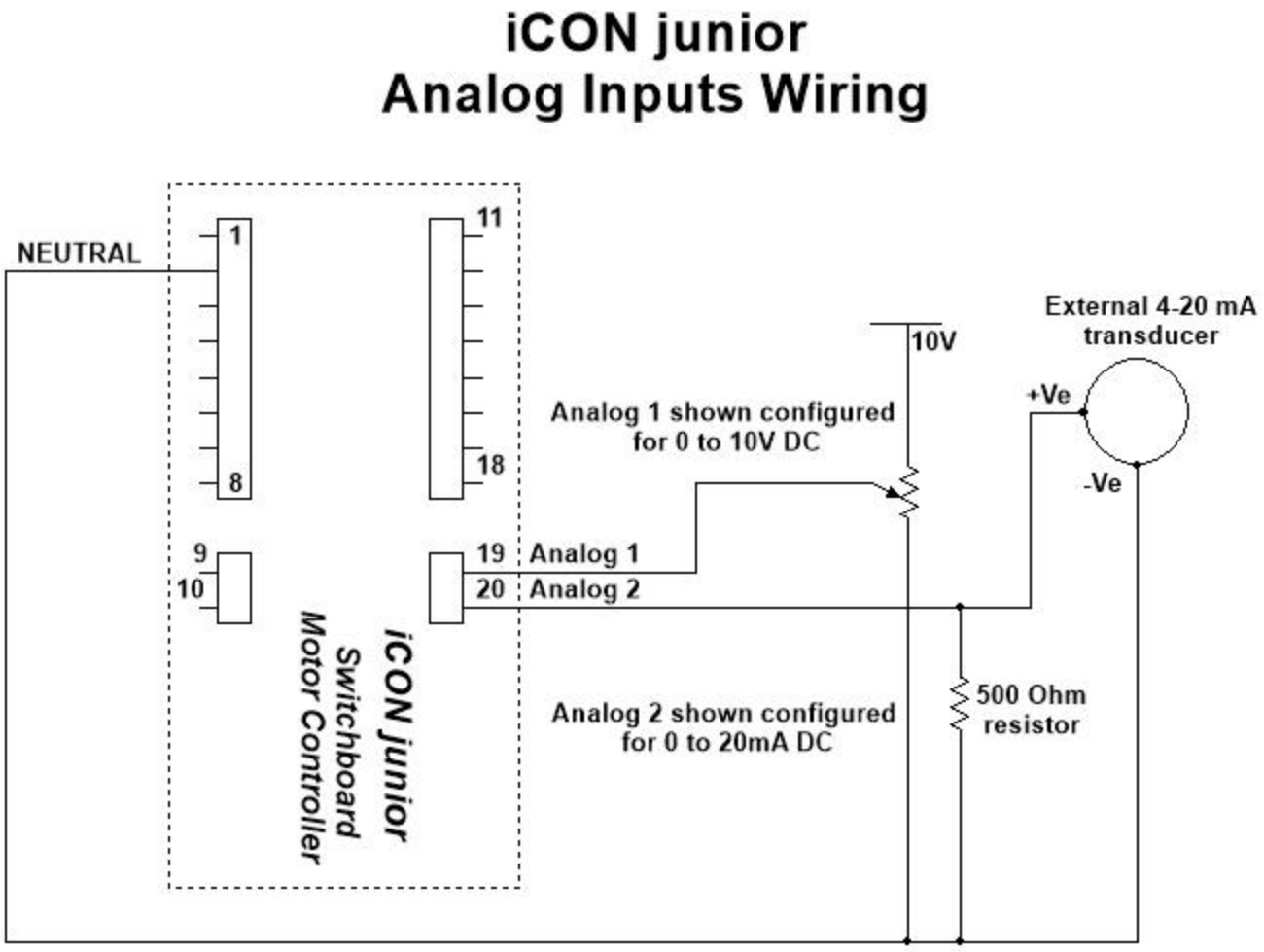
Example:
Parameter #45 is set to ‘NO’. The iCON junior receives a fault on Di-1 the contactor is opened and the alarm is still active on Di-1.The restart timer (Parameter#52) will count down to 1 minute and cease timing. It will stay in this dormant state until the alarm is cleared on Di-1. If parameter #45 had been set to “YES’ in this instance, the unit would have restarted automatically regardless of the active alarm state if Di-1.

# Analog Inputs

The iCON junior provides two Analog Inputs. The potential reference is based on neutral, so it is vital that the controller is wired correctly for AC power. The standard configuration is 0-10vdc. However, with the use of a shunt resistor and the correct setup of the offset menus, a 4-20ma signal can also be accepted.

Analog Input #1 is the only analog that can be configured to stop the equipment. Analog Input #2 is strictly for monitoring and has no control capability. With that exception both Analog Inputs have identical functionality.

***Figure 6 – Typical Connection***



Example #1:
An external 0-10vdc signal has been connected to Analog Input #1. The external device is a downhole sensor rated at 0-5000 PSI. Conditions dictate if the pressure falls below 500PSI or increases above 4900 PSI (indicating a loss of downhole signal) the iCON junior must stop operation of the equipment.

**Setup**
**Parameter #91~ 5000**
**Parameter #92~ 0**
**Parameter #93~ 4900**
**Parameter #94~ 500**

The actual engineering value can be seen in Parameter #89.

If a 4-20ma signal is used instead of a 0-10vdc, the offset and span can be adjusted accordingly. If using 4-20mA (or 0-20mA) a shunt resistance of 500 Ohms is required.

# Panel Light Indication and Auto Restarts

The indicators in a normal application will consist of a Red, Amber, and Green indicators.

The green indicator is normally wired in parallel with the motor contactor from terminal 11 of the iCON junior and is an indication of the unit operating.

The Amber indicator is connected to terminal 10 of the iCON junior. An amber indication illuminated serves to display to the user there are no active alarms and the iCON junior is timing out and will allow an automatic restart when the restart timer has reached zero.

The Red indicator is connected to terminal 9 of the iCON junior. An illuminated red indicator shows to the user that an active alarm is present and an automatic restart will not be allowed.

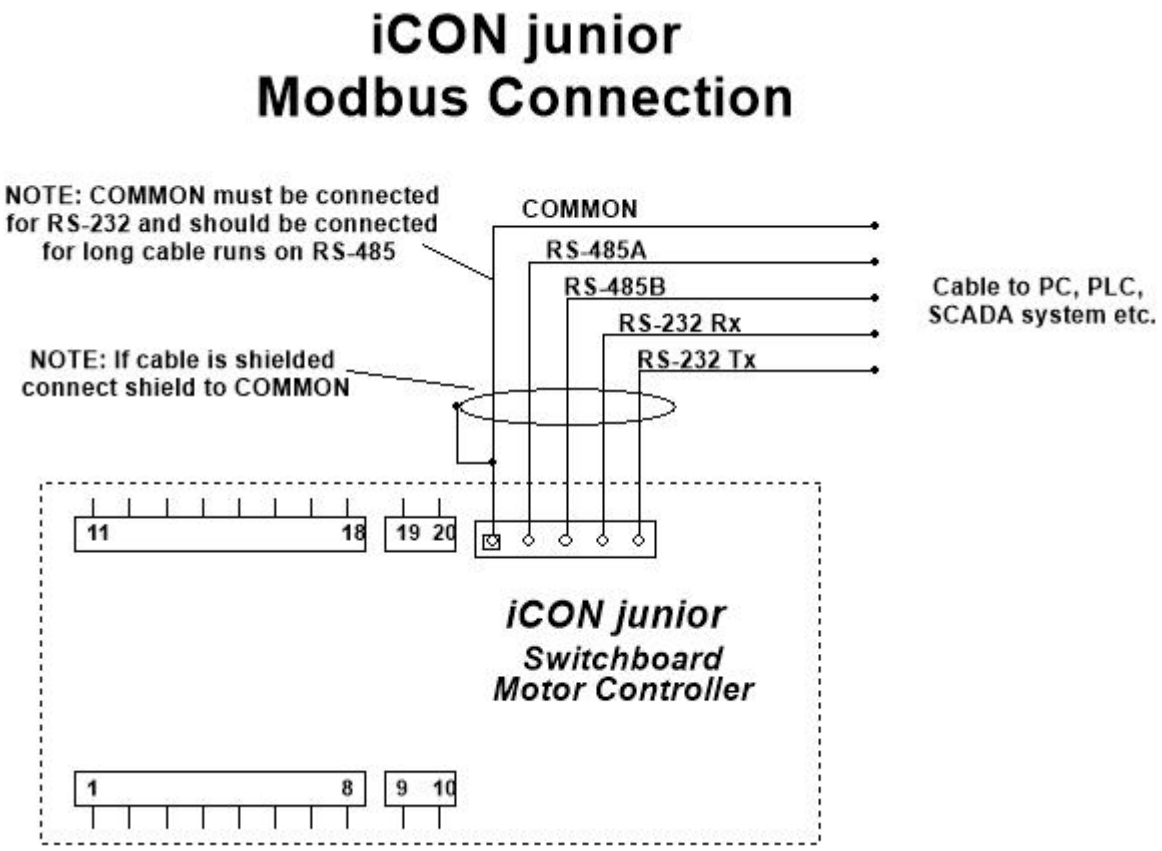
Automatic restarts are allowed only if no active alarms are present or an active alarm has been approved in the Parameter list to allow a restart. An example of this would be Parameter #45.

**Example #1:**
**Parameter # 27 (Voltage Unbalance Setpoint) ~ 10%**
**Parameter #52 (Restart Time) ~30 Minutes**

A voltage unbalance occurs due to an overhead line fuse opening. The iCON junior ceases motor operation. The red indicator will illuminate. The restart timer will count from the preset of 30 minutes. Once the restart timer has reached 1 minute and the active alarm has not cleared, the timer will stop at 1 minute. If the alarm clears the timer will continue its count. If, however, between a count of 1 minute to zero an alarm becomes active, the count will automatically be reset to 1 minute.

# PC / PLC / SCADA Modbus Interface

Through the serial Modbus comm interface (either RS/232 or RS/485) a PC, SCADA system or PLC can view and change the various parameters in the Motor Controller. The interface is completely electrically isolated from the motor controller. This allows access to remotely view all measurements, certain parameters in the motor controller may be modified and saved. The Modbus map is provided in the appendix.



# Ampchart Data Storage

The iCON junior has built in data storage for three currents, three Voltages, two analog levels, the state of the digital inputs and the display temperature. All of this data is stored on an SD card that it plugged into the front of the display. *Note, if the SD card is not installed or has an error condition the unit will not log any data.* Every 10 seconds the display will store all of these readings. Since SD cards will 'burn out' if they are constantly written to the display will only write the data every few minutes. It will rapidly flash the write LED a few times before writing, so if the user is about to remove the card and sees the LED flashing he should wait until the write completes. If the card is removed it is possible to lose the last 2 or 3 minutes of data as it was not written to the card. To prevent this data loss the operator may select menu C9 and enter 2, this will cause the display to flush all readings to the card and then it may be removed with the latest data stored. If the display detects that power is failing it will also flush the data and write to the card before the power is completely lost. The ampchart logged data will be stored in a file with the days date, each day a new file is started so it is easy to locate past data. A history 'event' log will also be stored on the card, in this case in just a single file. The supplied SD card (16GB) is large enough to hold approximately 50 years of amp chart data.

**Typical Log Data, saved as……**

Date,Time,Phase A,Phase B,Phase C,VAB,VAC,VBC,Analog 1 (raw),Analog 2 (raw),Display Temperature (°F)

01/19/24,21:01:02,0.0,0.0,0.0,1485.1,1587.7,1536.4,4828.5,88.2,0,0,83.0
01/19/24,21:01:13,0.0,0.0,0.0,1480.5,1591.1,1535.8,4827.1,88.2,0,0,83.0
01/19/24,21:01:23,0.0,0.0,0.0,1485.0,1591.5,1538.2,4827.5,88.2,0,0,83.0
01/19/24,21:01:53,0.0,0.0,0.0,1480.8,1591.1,1535.9,4831.1,88.2,0,0,83.0
01/19/24,21:02:03,0.0,0.0,0.0,1481.3,1588.3,1534.8,4827.3,88.2,0,0,83.0
01/19/24,21:02:13,0.0,0.0,0.0,1484.5,1589.4,1536.9,4827.8,88.1,0,0,83.0
01/19/24,21:02:23,0.0,0.0,0.0,1482.6,1589.2,1535.8,4831.5,88.2,0,0,83.0
01/19/24,21:02:33,0.0,0.0,0.0,1478.0,1592.3,1535.1,4828.2,88.1,0,0,83.0
01/19/24,21:02:43,0.0,0.0,0.0,1482.3,1590.9,1536.5,4828.1,88.2,0,0,83.0
01/19/24,21:02:53,0.0,0.0,0.0,1479.7,1589.0,1534.4,4827.3,88.2,0,0,83.0

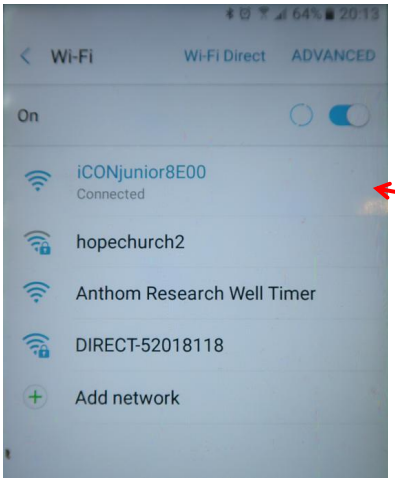
**Typical History Data, saved as….**

Date,Time,event

01/19/24,15:58:57,Display Power Failed
01/19/24,16:01:21,Display Power Restored
01/19/24,16:01:34,Manual Start
01/19/24,16:03:29,Manual stop
01/19/24,16:03:33,Manual Start
01/19/24,16:29:11,Rotation error
01/19/24,19:39:56,Auto Start
01/19/24,19:40:06,Current unbalance
01/19/24,19:40:16,Auto Start
01/19/24,19:40:25,Current unbalance
01/19/24,20:10:29,Auto Start
01/19/24,20:10:39,Current unbalance
01/19/24,20:40:43,Auto Start
01/19/24,20:40:53,Current unbalance

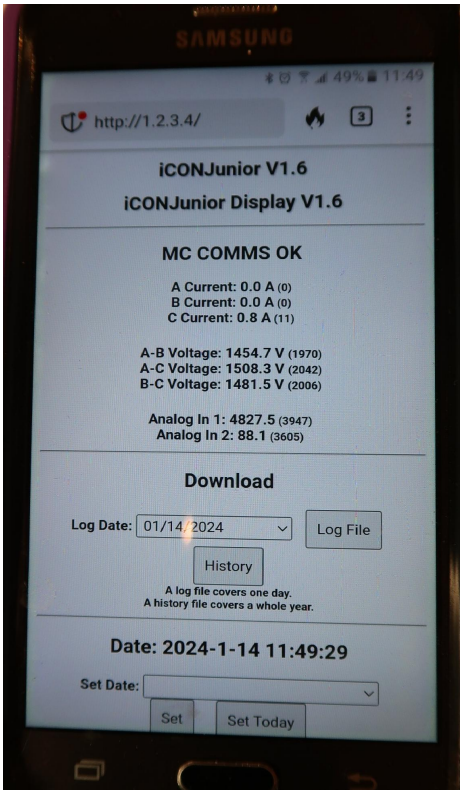
# WiFi Connection

The iCON junior is the worlds first switchboard motor controller that supports direct WiFi connections. This allows the operator(s) to monitor operational conditions, view logged faults, download history and Ampcharts directly to a smart phone, tablet or PC without getting out of the vehicle. Cell phone networks, internet access, routers, a local internet network etc. are *NOT* required to connect to the iCON junior, an operator can connect to it anywhere close by.




To connect to the iCON junior proceed as follows. First the users smartphone, tablet etc. (device) needs to be within a few hundred feet of the controller. Turn on the device and in the settings go to WiFi. Look at the list of available WiFi networks, and one should be visible called iCONjuniorXXXX where XXXX will be four characters. Each iCON junior controller has a unique address or ID, and the XXXX characters are the last four characters of the iCON junior MAC address so every iCON junior display will be different (8E00 in the example to the left). This is in case two or more iCON juniors are close to each other, the operator can make sure his or her device is connected to the correct controller.

Next connect to this network. During connection the users device may complain about being unable to access the internet; ignore this message and connect anyway, the internet is not required. Now open a web browser, such as Chrome (Android), Safari (Apple), Mozzilla, Edge or whatever you normally use. Then type as the web address 1.2.3.4 and a screen similar to below should appear. Note that more than one device or user can connect at the same time, but just one user at a time should download data to save confusion. The screen will typically update every 3 seconds or so, but may be slower if more than one user is connected. The system status and various parameters will be visible. Accumulated log data, stored on the iCON juniors display SD card, may be directly downloaded to the users device via WiFi. *Note, if the SD card is not installed or has an error condition the user will not be able to download data, and "download failed" message will appear on the users device.* Choose the log data by selecting the day of interest then click the 'log file' button. Each day a new file is generated, so past data is easy to locate. The history is also logged and may be downloaded in a similar way; however the history is a single file so there is no need to select the date.



# Shutdowns and Fault Handling

The restart counters are broken into 3 categories.
**1) - Overload**
**2) - Underload**
**3) - Faults**

Each has its own specific set of allowable restart counters in the Parameter list. Parameter #41 is used strictly to control the maximum allowed Underload restarts. Parameter #42 only deals with the maximum number of overload restarts. Parameter #43 handles all other restarts other than overload and underload to include the DI's.

The reset time (Parameter #53) functions as an internal counter reset to clear all three categories of start counters. It is a time based value. Simply stated, if the unit operates the motor for a time exceeding the value in the reset time all internal shutdown counts are reset. This does not change the values entered in parameters #41, #42, or #43. It clears the internal memory that tracks these shutdowns..

# Parameter List

| ID | Parameter Name | Maximum | Minimum | Units | Field Adjustable | Default | Description |
|---|---|---|---|---|---|---|---|
| 1 | A Phase Current | 999.9 | 0 | Amps | ✓ | N/A | Real Time A Phase Current – True RMS Value; Scaled Via CT Ratio |
| 2 | B Phase Current | 999.9 | 0 | Amps | ✓ | N/A | Real Time B Phase Current – True RMS Value; Scaled Via CT Ratio |
| 3 | C Phase Current | 999.9 | 0 | Amps | ✓ | N/A | Real Time C Phase Current – True RMS Value; Scaled Via CT Ratio |
| 4 | Average Current | 100.0 | 0 | Percent | ✗ | N/A | Real Time Current Average; ('A' Amps + 'B' Amps + 'C' Amps) / 3 |
| 5 | Current Unbalance | 999.9 | 0 | Percent | ✗ | N/A | Real Time Current Unbalance in Percent |
| 6 | Voltage A-B | 9999 | 0 | Volts | ✓ | | Real Time Voltage for Phases A & B |
| 7 | Voltage A-C | 9999 | 0 | Volts | ✓ | | Real Time Voltage for Phases A & C |
| 8 | Voltage B-C | 9999 | 0 | Volts | ✗ | | Real Time Voltage for Phases B & C |
| 9 | Average Voltage | 9999 | 0 | Volts | ✗ | | In single phase, Volts AB = average Volts in 3 phase mode, average Volts = (Volts AB + Volts AC + Volts BC)/3 |
| 10 | Voltage Unbalance | 100.0 0 | 0 | Percent | ✗ | | Real time Voltage unbalance |
| 11 | Rotation | ABC | CB A | Text | ✗ | | Real time rotation indication |
| 12 | Time Until Auto Restart | 999 | 0 | Minutes | ✗ | | Time until auto restart is attempted |
| 13 | Reason No Restart | | | | ✗ | | Reason will not auto restart |
| 14-20 | Reserved | | | | ✗ | | |
| 21 | Underload Setpoint | 999.9 | 0 | Amps | ✓ | 20.0 | Underload trip setpoint. Trip is determined from average current |
| 22 | Overload i2t factor | 128 | 0 | N/A | ✓ | 64 | Time factor considered in i2t calculations |
| 23 | Overload setpoint | 999.9 | 0 | Amps | ✓ | 80.0 | Overload trip setpoint. Trip is determined from average current |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 | Current unbalance | 100.0 | 0 | Percent | ✓ | 15.0 | |
| 25 | Undervoltage setpoint | 9999 | 0 | Volts | ✓ | 1000 | |
| 26 | Overvoltage Setpoint | 9999 | 0 | Volts | ✓ | 2000 | |
| 27 | Voltage Unbalance Setpoint | 100.0 | 0 | Percent | ✓ | 10.0 | |
| 28 | Rotation Setpoint | ABC | CB A | Text | ✓ | ABC | |
| 29 | Backspin Enable | Yes | No | Text | ✓ | No | |
| 30-36 | Reserved | | | | ✗ | | |
| 37 | Wait for Restart | Yes | No | N/A | ✓ | No | A “Yes” value in this register will not allow a restart remotely or locally unless restart time is zero. |
| 38 | Monitor 3 Phase Voltage | Yes | No | N/A | ✓ | No | Note: If the parameter is Set to NO, parameters 7, 8, 9, 27 & 28 are removed from the menu List |
| 39 | Current X Fomer Ration (X : 5) | 9999 | 0 | Amos | ✓ | 100 | |
| 40 | PT Ratio (X : 120) | 9999 | 0 | Volts | ✓ | 1500 | |
| 41 | Number of Allowed Underload Restarts | 100 | 0 | N/A | ✓ | 3 | 3 |
| 42 | Number of Allowed Overload Restarts | 100 | N/A | N/A | ✓ | 0 | |
| 43 | Number of Allowed Fault Restarts | 100 | 0 | N/A | ✓ | 3 | |
| 44 | Discrete Input #1 (N/O or N/C) | N/O | N/C | N/A | ✓ | N/O | |
| 45 | Allowed to Start with Active Alarm on DI-1 | Yes | No | N/A | ✓ | No | |
| 46 | Discrete Input #2 (N/O or N/C) | N/O | N/C | N/A | ✓ | N/O | |
| 47 | Allowed to Start with Active Alarm on DI-2 | Yes | No | N/A | ✓ | No | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 48-51 | Reserved | | | | ✗ | | |
| 52 | Restart Time | 999 | 0 | Minutes | ✓ | 30 | |
| 53 | Reset Time | 999 | 0 | Minutes | ✓ | 30 | |
| 54 | Fault Delay On Restart | 9999 | 0 | Seconds | ✓ | 5 | |
| 55 | Fault Shutdown Delay | 9999 | 0 | Seconds | ✓ | 5 | |
| 56 | Underload Delay on Start | 999 | 0 | Seconds | ✓ | 10 | |
| 57 | Underload Shutdown Delay | 999 | 0 | Seconds | ✓ | 30 | |
| 58 | Discrete #1 Delay on Start | 999 | 0 | Seconds | ✓ | 5 | |
| 59 | Discrete #1 Shutdown Delay | 999 | 0 | Minutes | ✓ | 5 | |
| 60 | Discrete #2 Delay on Start | 999 | 0 | Seconds | ✓ | 5 | |
| 61 | Discrete #2 Shutdown Delay | 999 | 0 | Seconds | ✓ | 5 | |
| 62-69 | Reserved | | | | ✗ | | |
| 70 | Alarm at last shutdown | N/A | N/A | N/A | ✗ | | |
| 71 | Alarm at 2nd to last shutdown | N/A | N/A | N/A | ✗ | | |
| 72 | Alarm at 3rd to last shutdown | N/A | N/A | N/A | ✗ | | |
| 73 | Alarm at 4th to last shutdown | N/A | N/A | N/A | ✗ | | |
| 74 | Alarm at last shutdown | N/A | N/A | N/A | ✗ | | |
| 75 | Total starts count | 65535 | 0 | Text | ✗ | | |
| 76 | Re-settable starts count | 65535 | 0 | Text | ✗ | | |
| 77 | Total run time | 65535 | | | ✗ | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 78 | Re-settable run time | 65535 | 0 | Hours | ✗ | | |
| 79-88 | Reserved | | | | ✗ | | |
| 89 | Analog Input #1 Real Time Value | 9999 | 0 | N/A | ✗ | | |
| 90 | Analog Input #2 Real Time Value | 9999 | 0 | N/A | ✗ | | |
| 91 | Analog Input #1 Span | 9999 | 0 | N/A | ✓ | 5000 | |
| 92 | Analog Input #1 Offset | 9999 | 0 | N/A | ✓ | 0 | |
| 93 | Analog Input #1 High Trip | 9999 | 0 | N/A | ✓ | 5000 | |
| 94 | Analog | 9999 | 0 | N/A | ✓ | 0 | |
| 95 | Analog Input #2 Span | 9999 | 0 | N/A | ✓ | 100 | |
| 96 | Analog Input #2 Offset | 9999 | 0 | N/A | ✓ | 0 | |
| 97 | Controller Serial Number | 9999 | 0 | N/A | ✗ | | |
| 98 | Controller Firmware Revision | 9999 | 0 | N/A | ✗ | | |
| 99 | Display Serial Number | 9999 | 0 | N/A | ✗ | | |
| A1 | Display Firmware Serial Number | 9999 | 0 | N/A | ✗ | | |
| C5 | MB Remote Control Enabled | YES | NO | N/A | ✗ | NO | Change with C9 menu. See Modbus Remote Control section |
| C6 | Comm Port Baud Rate | 38400 | 120 0 | Bits per second | ✓ | 9600 | Changes baud rate of comm port |
| C7 | Modbus ID (Slave Address) | 255 | 1 | Text | ✓ | 1 | |
| C8 | Timeout | 999 | 0 | milli Seconds | ✓ | 40 | Delay for Modbus reply |
| C9 | Code | 9999 | 0 | N/A | ✓ | | Factory use only |

# Parameter Definitions

**Parameter #1**
**A Phase Current**
This is a real time value of the actual current passing through the A phase current transformer. This parameter is adjustable for fine tuning purposes.

**Parameter #2**
**B Phase Current**
This is a real time value of the actual current passing through the B phase current transformer. This parameter is adjustable for fine tuning purposes.

**Parameter #3**
**C Phase Current**
This is a real time value of the actual current passing through the C phase current transformer. This parameter is adjustable for fine tuning purposes.

**Parameter #4**
**Average**
**Current**
This is a real time value. It is the average of A, B, and C Phase currents**.**

**Parameter #5**
**Current**
**Unbalance**
This is a real time value and represents the % of imbalance between the highest and lowest of the three currents.

**Parameter**
**#6 Voltage**
**A-B**
This is a real time value of the voltage potential between A phase and B phase line. This reading is a product of the actual Voltage scaled via the PT ratio. This parameter is adjustable for fine tuning, and is not available in menu list if parameter #38 is set to 'NO'.

**Parameter**
**#7 Voltage**
**A-C**
This is a real time value of the voltage potential between A phase and C phase line. This reading is a product of the actual voltage scaled via the PT Ratio. This parameter is adjustable for fine tuning. This is also the input that provides the primary power for the iCON junior.

**Parameter**
**#8 Voltage**
**B-C**
This is a real time value of the voltage potential between B Phase and C Phase line. This reading is a calculated voltage based off of A-C and A-B inputs. This parameter is adjustable for fine tuning, and is not available in menu list if parameter #38 is set to 'NO'.

**Parameter #9**
**Average**
**Voltage**
This is a real time value the average of the three line voltages, and is not available in menu list if parameter #38 is set to 'NO'.

**Parameter #10**
**Voltage**
**Imbalance**
This is a real time value representing the % of imbalance between the highest and lowest of the three line voltages, and is not available in menu list if parameter #38 is set to 'NO'.

**Parameter**
**#11 Rotation**
This is a real time value representing the actual rotation sequence of the incoming line, and is not available in menu list if parameter #38 is set to 'NO'.

**Parameter #12**
**Time Until Auto Restart**
This is a real time value representing the time until the iCON junior will attempt to automatically restart the equipment.

**Parameter #13**
**Reason for No**
**Restart**
This give the user indications of what active alarms are present prohibiting the iCON junior from starting the equipment. Below is a list of possible display and corresponding meanings.

| | |
|---|---|
| OVT | Overvoltage |
| UVT | Undervoltage |
| VUB | Voltage unbalance |
| ROT | Rotation error |
| DI1 | Digital Input 1 Active |
| DI2 | Digital Input 2 Active |
| AN1L | Analog 1 Below "Low Setpoint" |
| AN1H | Analog 1 Above "Hi Setpoint" |

**Parameter**
**#14-20**
**Reserved**

**Parameter #21**
**Underload**
**Setpoint**
This is a user defined value. If the AVERAGE of the three currents (parameter #4) falls below this setpoint for a duration that exceeds the underload delay timer, the iCON junior will stop the operation of the equipment.

**Parameter #22**
**Overload I (2)T Factor**
This is a user defined parameter. This is the reaction factor for initiating an Overload trip. The lower the number the quicker the reaction to an Overload.

**Parameter #23**
**Overload**
**Setpoint**
This is a user defined parameter. If the average current (parameter #4) exceeds this setpoint the iCON junior will stop the operation of the equipment. The time it take to initiate an overload trip

spends on the amount the average current exceeds the overload setpoint and the I(2)T factor in parameter #22.

**Parameter #24**
**Current Unbalance Set point**
This is a user defined setpoint. If the actual current unbalance (parameter #5) exceeds this setpoint for a duration greater than the fault shutdown delay timer (parameter #55) the iCON junior will stop the operation of the equipment.

**Parameter #25**
**Under Voltage Setpoint**
This is a user defined setpoint. If the average voltage (parameter #9) falls below this setpoint for a duration greater than the fault shutdown delay timer (parameter #55) the iCON junior will stop the operation of the equipment.

**Parameter #26**
**Over Voltage Setpoint**
This is a user defined setpoint. If the average voltage (parameter #9) exceeds this setpoint for a duration greater than the fault shutdown delay timer (parameter #55) the iCON junior will stop the operation of the equipment.

**Parameter #27**
**Voltage Unbalance Setpoint**
This is a user defined setpoint. If the actual voltage unbalance (parameter #10) exceeds this setpoint for a duration greater than the fault shutdown delay timer (parameter #55) the iCON junior will stop the operation of the equipment.

**Parameter #28**
**Rotation**
**Setpoint**
This is a user defined setpoint. If the actual rotation is different than the value entered into this setpoint the iCON junior will stop the operation of the equipment.

**Parameter**
**#29 - 36**
**Reserved**

**Parameter #37**
**Wait For Restart Timer?**
This is a user defined parameter. If a “YES” is entered into this parameter the iCON junior will not allow a manual restart via the HOA and Start button. The unit can not be started until the restart timer has timed out.

**Parameter #38**
**Monitor 3 Phase**
**Power**
This is a user defined parameter. Entering a “YES” into this parameter indicates noting is connected to the sensing volts terminal. Therefore you do not have the capability to monitor three voltages.

**Parameter #39**
**Current Transformer Ratio (X:5)**
This is a user defined parameter. The actual current transformer value is entered in this parameter. It is based on X:5. If you are using 75:5 CT’s, then the value of 75 will be entered.

**Parameter #40**
**PT Ratio (X:120)**
This is a user defined parameter. The actual PT tap setting is entered in this parameter.

**Parameter #41**

**Number of Allowed Underload Restarts**
This is a user defined parameter. The maximum number of allowed underload restarts before the iCON junior will perform a lockout condition.

**Parameter #42**
**Number of Allowed Overload Restarts**
This is a user defined parameter. The maximum number of allowed overload restarts before the iCON junior will perform a lockout condition.

**Parameter #43**
**Number of Allowed Fault Restarts**
This is a user defined parameter. The maximum number of allowed fault restarts before the iCON junior will perform a lockout condition.

**Parameter #44**
**Discrete Input #1 N/O or N/C?**
This is a user defined parameter. If "N/C" is entered into this parameter the iCON junior will stop operation of the equipment if 120VAC is present on terminal #14.
If "N/O" is entered into this parameter the iCON junior will stop operation of the equipment if 120VAC is present on terminal #14.

**Parameter #45**
**Allow Start with Active Alarm on Digital Input #1**
This is a user defined parameter. If this parameter is set to "NO" the iCON junior will not allow an automatic restart or a manual start with Di-1 alarm active.

**Parameter #46**
**Discrete Input #2 N/O or N/C?**
This is a user defined parameter. If "N/C" is entered into this parameter the iCON junior will stop operation of the equipment if 120VAC is not present on terminal #8.
If "N/O" is entered into this parameter the iCON junior will stop operation of the equipment if 120VAC is present on terminal #8.

**Parameter #47**
**Allow Start with Active Alarm on Digital Input #2**
This is a user defined parameter. If this parameter is set to "NO" the iCON junior will not allow an automatic restart or a manual start with Di-2 alarm active.

**Parameter #48 - #51**
**Reserved**

**Parameter #52 Restart Time**
This is a user defined parameter. The value entered in this parameter is the time the iCON junior must wait before it attempts an automatic restart.

**Parameter #53 Reset Time**
This is a user defined parameter. The value entered in this parameter is the time the iCON junior must be operating the equipment (RUN) before the Underload, Overload, and Fault counters are reset.

**Parameter #54**
**Fault Delay on Start Timer**
This is a user defined parameter. The value entered in this parameter is the time the iCON junior will ignore a active fault on startup before it initiates a stop command.
**Parameter #55**

**Fault Shutdown Delay Timer**
This is a user defined parameter. The value entered in this parameter is the time the iCON junior will ignore a active while running before it will initiate a stop command.

**Parameter #56**
**Underload Delay on Start Timer**
This is a user defined parameter. The value entered in this parameter is the time the iCON junior will ignore a active underload on startup before it initiates a stop command.

**Parameter #57**
**Underload Shutdown Delay Timer**
This is a user defined parameter. The value entered in this parameter is the time the iCON junior will ignore an active underload while running before it will initiate a stop command.

**Parameter #58**
**Digital Input #1 Delay on Start Timer**
This is a user defined parameter. The value entered in this parameter is the time the iCON junior will ignore a active Digital Input #1 alarm on startup before it initiates a stop command.

**Parameter #59**
**Digital Input #1 Shutdown Delay Timer**
This is a user defined parameter. The value entered in this parameter is the time the iCON junior will ignore a active Digital Input #1 alarm while running before it will initiates a stop command.

**Parameter #60**
**Digital Input #2 Delay on Start Timer**
This is a user defined parameter. The value entered in this parameter is the time the iCON junior will ignore a active Digital Input #2 alarm on startup before it initiates a stop command.

**Parameter #61**
**Digital Input #2 Shutdown Delay Timer**
This is a user defined parameter. The value entered in this parameter is the time the iCON junior will ignore a active Digital Input #2 alarm while running before it will initiate a stop command.

**Parameter**
**62-69**
**Reserved**

**Parameter #70**
**Alarm @Last Shutdown**
This parameter displays the last shutdown alarm that occurred.

**Parameter #71**
**Alarm @ 2nd Last Shutdown**
This parameter displays the 2nd last shutdown alarm that occurred.

**Parameter #72**
**Alarm @ 3rd Last Shutdown**
This parameter displays the 3rd last shutdown alarm that occurred.

**Parameter #73**
**Alarm @ 4th Last Shutdown**
This parameter displays the 4th last shutdown alarm that occurred.

**Parameter #74**
**Alarm @ 5th Last Shutdown**
This parameter displays the 5th last shutdown alarm that occurred.

**Legend For Parameter #70-#74**

| | |
|---|---|
| OLD | Current overload |
| ULD | Current underload |
| CUB | Current unbalance |
| OVT | Overvoltage |
| UVT | Undervoltage |
| VUB | Voltage unbalance |
| ROT | Rotation error |
| DI1 | Digital Input 1 Active |
| DI2 | Digital Input 2 Active |
| AN1L | Analog 1 Below "Low Setpoint" |
| AN1H | Analog 1 Above "Hi Setpoint" |
| MAN | Manual stop |
| PUV | Power failed |

**Parameter #75**
**Total Starts Counter**
**This displays the total number of starts the iCON junior has performed. This is not changeable.**

**Parameter #76**
**Res-settable starts counter**
This displays the number of start the iCON junior has performed since being reset.

**Parameter #77**
**Total run hours**
This displays the TOTAL number of hours the iCON junior has run. This is not changeable.

**Parameter #78**
**Res-settable run hours**
This displays the number of hours the iCON junior has ran since being reset.

**Parameter #79-88**
**Reserved**

**Parameter #89**
**Analog Input #1 real time value**
This parameter displays the real time engineered value of analog input #1**.**

**Parameter #90**
**Analog Input #2 real time value**
This parameter displays the real time engineered value of analog input #2.

**Parameter #91**
**Analog Input #1 span**
This is a user defined value. The maximum number displayed when the raw value input of 10vdc is applied to terminal #19 of the iCON junior.

**Parameter #92**
**Analog Input #1 offset**
This is a user defined value. When utilizing this analog input with a process value where 0 engineered value is not equivalent to a raw value of zero. Calculating the offset will allow the user to make a positive process value be displayed as zero without distorting the linear display to span.

**Parameter #93**
**Analog Input #1 high trip**
This is a user defined setpoint. If the engineered value parameter #89) exceeds this setpoint for a

duration greater than the fault shutdown delay timer (parameter #55) the iCON junior will stop the operation of the equipment.

**Parameter #94**
**Analog Input #1 Low Trip**
This is a user defined setpoint. If the engineered value (parameter #89) falls below this setpoint for a duration greater than the fault shutdown delay timer (parameter #55) the iCON junior will stop the operation of the equipment.

**Parameter #95**
**Analog Input #1**
**Span**
This is a user defined value. The maximum number displayed when the raw value input of 10vdc is applied to terminal #19 of the iCON junior.

**Parameter #96**
**Analog Input #2 Offset**
This is a user defined value. When utilizing this analog input with a process value where 0 engineered value is not equivalent to a raw value of zero. Calculating the offset will allow the user to make a positive process value be displayed as zero without distorting the linear display to span.

**Parameter #97**
**Controller Serial Number**
Displays the Serial Number of the Motor Controller

**Parameter #98**
**Controller Firmware Revision**
Displays the firmware residing in the Motor Controller

**Parameter #99**
**Display Serial Number**
Displays the Serial Number of the Display

**Parameter #A1**
**Display Firmware Revision**
Displays the firmware residing in the Display

**Parameter # C5**
**Modbus Remote Control Enabled**
This displays whether Modbus remote control is enabled. It is changed in the C9 menu by first entering 7 to unlock the device, then entering the value 15 to enable, 16 to disable.

**Parameter # C6**
**Comm #1 Port Baud Rate**
This is a user-defined parameter. Enter the Baud Rate From 1200 to 38400

**Parameter # C7**
**Modbus ID**
This is a user-defined parameter. Enter the Modbus slave ID number

**Parameter # C8**
**Timeout**
This is a user-defined parameter. Modbus communication timeout value.

**Parameter # C9**
**Code**
Factory test. Enter 1 for LED test.

# Modbus Map

Read with Modbus command 0x03 or 0x04

0 - 499 Read Only
500 - 999 Write enabled data, limits, configuration, scaling etc. R/W
1000 - 65535 Analog results. Read Only

0 Digital Input Status (0=open, 1 = closed). Bit 0 = Start, 1 = Digital Input 1 , 2=Hand, 3=Auto, 4=Digital Input 2
1 Digital Output Status (0=open, 1 = closed) Bit 0 = Contact, 1 = Red, 2 = Amber
2 Number of starts since power fail
3 Number of overloads since power fail
4 Motion state
5 Reason cannot start. Following are the reasons….
- 0 No reason
- 1 Current still exists
- 2 Phase error
- 3 UL restarts exceeded
- 4 HOA wiring error (hand and auto active at same time)
- 5 OL restarts exceeded
- 6 Fault restarts exceeded
- 7 Locked out
- 8 Over Voltage
- 9 Under Voltage
- 10 Voltage Inbalance
- 11 Dig 1 Active
- 12 Dig 2 Active
- 13 Analog too high
- 14 Analog to low

6 Under load restarts
7 Over load restarts
8 Fault restarts
9 Rotation

200 Most recent history event
201 next most recent " "
"
"
455 Oldest history event

The history events are stored as follows
- 1 Overload
- 2 Underload
- 3 Current Unbalance
- 4 Voltage Overload
- 5 Voltage Underload
- 6 Voltage Umbalanced
- 7 Rotation
- 8 Digital Input 1
- 9 Digital Input 2
- 10 Analog 1 High
- 11 Analog 1 Low
- 12 Manual Stop
- 13 Power Restored
- 14 Brownout Detected
- 15 Display Power Failed
- 16 Display Power Restored
- 17 Display Brownout Detected
- 18 Remote Start
- 19 Remote Stop
- 20 Remote Connected

| | |
|---|---|
| 21 | Remote Lost |
| 22 | Remote Lockout Cleared |
| 23 | Manual Start |
| 24 | Manual Stop |
| 25 | Nothing |

500 Modbus ID, 1 to 254 users ID. We also always respond to Modbus address 255 for config, and 0 for broadcast (if enabled)
501 0 = ignore Modbus broadcast commands, 1= accept broadcast commands
502 Timeout in seconds before reverting to normal operation after Modbus override stops
503 Modbus silent time in mS. Handles breaks in packets caused by modems etc
504 Current overload setpoint. 16 bit in raw
505 I2T Parameter i2tset. 1 to 127
506 Current underload setpoint. 16 bit raw.
507 Current underload startup ignore time in seconds. 0 - 65535
508 Reset Time
509 Restart Time
510 Modbus baud rate. 0 = 1200, 1=2400, 2=4800, 3=9600, 4=19200, 5 = 38400 baud
511 Current underload stop/active time.
512 Fault stop/active time.
513 Input one stop/active time.
514 Input two stop/active time.
515 Fault startup ignore time.
516 Input one startup ignore time.
517 Input two startup ignore time.
518 Input One NC/NO shutdown state.
519 Input Two NC/NO shutdown state.
520 Overload restarts allowed.
521 Underload restarts allowed.
522 Fault restarts allowed.
523 Wait for timer before starting 0 = yes, 1 = no.
524 Rotation setting 0 = ABC, 1 = CBA, 3 ignore.
525 Three phase setting 0 = three phase, 1 = single phase.
526 Under voltage set point.
527 Over voltage set point.
528 Voltage imbalance set point.
529 Current imbalance set point.
531 Modbus remote control enabled. 0 = no, 1 = yes. Enable by writing 21930, disable by writing anything else.
600 Serial Number
601 Software version 12 = 1.2 etc
602 Total starts
603 Total running hours (non re-setable).
604 Display Serial Number
605 Display Software version 12 = 1.2 etc
606 Display EEPROM Fastest update rate
607 Display Run hours
608 Re-setable run hours.

Following User R/W. Not used for anything inside the controller - just a repository for the display / PC
700 Calibration factor VCA 0x8000 default, 0xC000 max, 0x4000 minimum
701 Calibration factor VAB 0x8000 default, 0xC000 max, 0x4000 minimum
702 Calibration factor Current A 0x8000 default, 0xC000 max, 0x4000 minimum
703 Calibration factor Current B 0x8000 default, 0xC000 max, 0x4000 minimum
704 Calibration factor Current C 0x8000 default, 0xC000 max, 0x4000 minimum
705 PT Ratio 1 to 600 (Multiply 10 Vrms)
706 SPARE
707 CT Ratio 1 to 250 (multiply by 5A for 5-1250 Amp setting

996 Modbus remote control ‘keep alive’ register. See Modbus remote control section.
999 Modbus remote control register. See Modbus remote control section.

1000 Last reading. Phase A Current. , scaled. 0 - 0xFFFF 0xFFFF = 15 Amps AC; 0x5555 = 5 Amps.
1001 Last Reading. Phase B Current. Last reading, scaled. 0 - 0xFFFF 0xFFFF = 15 Amps AC; 0x5555 = 5 Amps.
1002 Last Reading. Phase C Current. Last reading, scaled. 0 - 0xFFFF 0xFFFF = 15 Amps AC; 0x5555 = 5 Amps.
1003 Last Reading. Voltage A-B . Scaled, 0 - 0xFFFF 0xFFFF = 240 Volts AC; 0x7FFF = 120 VAC
1004 Last Reading. Voltage C-A. Scaled, 0 - 0xFFFF 0xFFFF = 240 Volts AC; 0x7FFF = 120 VAC
1005 Last Reading. Analog Input 1, 0 - 10 VDC. Unscaled, 0 - 0xFFFF
1006 Last Reading. Analog Input 2, 0 - 10 VDC. Unscaled, 0 - 0xFFFF
1007 Last second average reading Phase A Current. Scaled. 0 - 0xFFFF
1008 Last second hi reading
1009 Last Second low reading
1010 Last second average reading Phase B Current.
1011 Last second hi reading
1012 Last Second low reading
1013 Last second average reading Phase C Current.
1014 Last second hi reading
1015 Last Second low reading
1016 i2tcurrent
1020 Scaled Phase A current. e.g. 1234 = 123.4 Amps
1021 Scaled Phase B current. e.g. 1234 = 123.4 Amps
1022 Scaled Phase C current. e.g. 1234 = 123.4 Amps
1023 Scaled Vab Voltage e.g. 12345 = 1234.5 Volts
1024 Scaled Vca Voltage e.g. 12345 = 1234.5 Volts
1025 Scaled Vbc Voltage e.g. 12345 = 1234.5 Volts
1026 Scaled Analog 1 Value in user defined units
1027 Scaled Analog 2 Value in user defined units

3318 Write 1234 to restore to default settings. Write 5678 to copy all settings to EEPROM

# Modbus Remote Control Modes.

There are two modes for remote Modbus control. The first mode (A) is preserved for compatibility with old installed systems; it is not recommended for new installations. The second (B) is a new addition to the iCON junior's capability (requires F/W 2.1 or newer)

Mode A. This mode must have the MB ID set between 201 and 250 to operate, and the mode will automatically be turned on if the MB address is set in this range. It then uses register 996 to write commands to the controller, the following commands will be processed. Writing 49853 to register 996 will clear any lockout conditions that prevent the controller from starting, similar to changing the HOA from Hand or Auto to Off then back to Hand or Auto. Note, however persistant lockouts eg an active digital input will still prevent the controller from starting. Writing 38639 to register 996 will stop the controller if it is running. If the controller is running it will continue to run providing 65111 is written to register 996 at least every 10 minutes; otherwise it will stop after this timeout. The controller will start by itself if (i) there are no lockouts, (ii) its in Auto mode and (iii) the restart timer expires. There is no capability to start the controller on demand remotely in this mode. The controller must be connected and constantly 'pinged' at least every 10 minutes to keep running if its Modbus address is between 201 and 250.

Mode B. This mode must have the MB ID set outside of the 201 to 250 range to operate. To enable this remote control mode first use the C9 menu to enter 7, this will unlock the controller for 1 minute. Then enter 15 in the C9 menu to enable the remote control mode, or 16 to disable remote control capability. It can also be enabled by writing 21930 to MB 531, which will return 1 if enabled, 0 if disabled. Writing anything else to 531 will disable remote control mode. Menu C5 displays (but wont change) whether remote control is enabled. Once remote control is enabled the following commands can be written to MB 999. Writing 49853 to register 999 will clear any lockout conditions such as too many underloads that prevent the controller from starting, similar to changing the HOA from Hand or Auto to Off then back to Hand or Auto. Note, persistant lockouts e.g. an active digital input will still prevent the controller from starting. Writing 43605 to 999 will have the same effect as pushing the start button; the controller may or may not start depending on existing conditions, such as HOA position, digital inputs etc. Writing anything except 43605 or 49853 to 999 will stop the controller if it is running. The controller will keep running until an error condition, user switching HOA to Off or remote command to stop occur, there is no need to keep 'pinging' the controller for it to keep running.

# PRODUCT WARRANTY

Anthom Research LLC ("AR LLC") warrants AR LLC manufactured products ("Product") to be free of workmanship and material defects for a period of twenty four (24) months from the date of shipment to Buyer.

AR LLC, at its option, will at no charge either repair, replace, or refund the purchase price of the Product during the warranty period, provided it is returned in accordance with the terms of this warranty to Anthom Research at the Tulsa, OK location. At AR LLC option, it may include the replacement of parts or boards with functionally equivalent reconditioned or new parts or boards.
Replaced parts or boards are warranted for the balance of the original applicable warranty period. All replaced parts, boards or Product shall become the property of AR LLC. Shipping costs are to be borne by the purchasing party.
This express warranty is extended by AR LLC to the party purchasing the Product ("Buyer") and is not assignable or transferable to any other party. This is the complete warranty for the Products, except as modified by separate agreement between AR LLC and Buyer.
AR LLC is not responsible under this warranty for ancillary equipment, whether or not manufactured by AR LLC, which is attached to or used in connection with the Product, nor for operation of the Product with any such with any such ancillary equipment.
Because each Product system is unique, AR LLC disclaims liability for range, coverage, or operation of the system as a whole under this warranty.
This warranty applies within the fifty (50) United States and the District of Columbia.

**WHAT THIS WARRANTY DOES NOT COVER:**
(a) Defects or damage resulting from use of the Product in other than its normal and customary manner.
(b) Defects or damage from misuse, accident or neglect.
(c) Defects or damage from improper testing, operation, maintenance, installation, alteration, modification or adjustment.
(d) Product disassembled or repaired in such a manner as to adversely affect performance or prevent adequate inspection and testing to verify any warranty claim.
(e) Product which has had the serial number removed or made illegible.

**HOW TO GET WARRANTY SERVICE:**
To receive warranty service, call 918-766-4628.

**GENERAL PROVISIONS:**

**This warranty sets forth the full extent of AR LLC's responsibilities and liability regarding the Product, and repair, replacement, or refund of the purchase price, at AR LLC's option, is Buyer's exclusive remedy.**

**By issuing a purchase order and agreeing to purchase the equipment the buyer is deemed to agree to this warranty and AR LLC will not be bound by any other buyers terms or conditions.**

THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHICH ARE SPECIFICALLY EXCLUDED INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN NO EVENT SHALL AR LLC BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT, FOR ANY LOSS OF USE, LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS, LOST PROFITS OR SAVINGS OR OTHER INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE SUCH PRODUCT.

**PATENT AND SOFTWARE PROVISIONS:**

AR LLC will defend at its own expense any suit brought against Buyer to the extent that it is based on a claim that the Product or parts infringes a United States patent, and AR LLC will pay those costs and damages finally awarded against Buyer in any such suit which are attributable to any such claim, but such defense and payments are conditioned on the following: (i) that AR LLC will be notified promptly in writing by Buyer of any notice of such claim; and (ii) that AR LLC will have sole control of the defense of such suit and all negotiations for its settlement or compromise; and (iii) should the Product or parts become, or in AR LLC's opinion be likely to become, the subject of a claim infringement of a United States patent, that Buyer will permit AR LLC, at its option and expense, either to procure for Buyer the right to continue using the Product or parts or to replace or modify the same so that it becomes non-infringing or to grant Buyer a credit for the Product or parts as depreciated and accept its return. The depreciation will be an equal amount per year over the lifetime of the Product or parts as established by AR LLC.
AR LLC will have no liability with respect to any claim of patent infringement, which is based upon the combination of the Product or parts furnished by AR LLC, nor will AR LLC have any liability for the use of ancillary equipment or software not furnished by AR LLC, which is attached to or used in connection with the Product. **The foregoing states the entire liability of AR LLC with respect to infringement of patents by the Product or any parts thereof.**

Laws in the United States and other countries preserve for AR LLC certain exclusive rights for copyrighted AR LLC software such as the exclusive rights to reproduce in copies and distribute copies of such AR LLC software. AR LLC software may be copied into, used in and redistributed with only the Products associated with such AR LLC software. No other use, including without limitation disassembly, of such AR LLC software or exercise of exclusive rights in such AR LLC software is permitted. No license is granted by implication, estoppel or otherwise under the patent rights of AR LLC or any third party.

**Laws in the United States and other countries preserve for AR LLC certain exclusive rights for copyrighted AR LLC software such as the exclusive rights to reproduce in copies and distribute copies of such AR LLC software. AR LLC software may only be copied into and used in products manufactured by AR LLC. No other use, including without limitation disassembly, of such AR LLC software is permitted. No license is granted by implication, or otherwise under the patent and intellectual rights of AR LLC to any third party.**