

# Messenger W

User Manual

9M02-7000-A001-EN



CONNECT. CONTROL. PROTECT.

## Revision History

| VERSION | DATE    | NOTES                                              |
|---------|---------|----------------------------------------------------|
|         |         | Initial Release                                    |
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| A       | 11/2020 | Document rebranded and contact information updated |

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## Introduction

This User Manual describes installation and setup of the Messenger W product.

The Messenger W is a complete monitoring, alarm notification and telemetry platform. It supports monitoring of data values from onboard physical IO.

### Features

The hardware feature set of this platform includes the following:

- Battery-backed on power fail
- Power fail detection
- Three Digital Inputs (user configurable to accept a voltage or ground input)
- One Digital Output (transistor closures to ground)
- One Analog Input (10-bit, user configurable for V or mA input)
- 3G or LTE cellular modem and antenna



# 1 Description

## 1.1 Capabilities

The Messenger W is a highly configurable platform for remote monitoring and control applications. Some of the capabilities are listed below.

- Local computations from monitored conditions
- Time stamping of monitored data and events
- Battery-backed historical data/event buffers
- Automatic monitoring of max/min for analog values
- Event and data logging
- Telemetry of monitored conditions to host server-based applications via cellular
- Over-The-Air (OTA) programming and diagnostics
- SMS messages sent on monitored conditions
- Parameter setting via SMS messages
- Rate of change alarm/flow totalization on physical analog input channel
- Pulse counter on all physical digital input channels
- High/low warning/alarm on all analog channels
- Daily count and duration alarm on all physical digital input channels

## 1.2 Monitoring

All monitored values can be transmitted via cellular to a host server of the customer's choosing. Monitored values are transmitted based on time or notification events. Notification events are based on rules set by the user and each event can generate an immediate report. Telemetry includes cellular data connectivity to host server or SMS messaging direct to user.

Monitored data values are mapped to fixed channels in the Messenger W. A channel defines a set of attributes for the monitored data for doing calculations, alarm detection, data formatting and reporting.

For example, the physical analog input is fixed to channel 62. For channel 62, the user can set high/low limits to generate notifications to a host server or directly to the user via SMS.

A description of all the predefined channel numbers can be found in the [Defined Channels](#) section.

## 1.3 Host Server Communications

The Messenger W utilizes a proprietary protocol to send notifications and to receive OTA commands from a host server. Each notification sent typically consists of location, date/time, an event code and associated data. An event code provides a unique identifier to indicate the reason that the notification is being sent – for example, normal scheduled update or an alarm detection event. A description of the protocol, format of messages and definition of event codes is available on request (document number “M09-PRTCLxxx”).



Some of the conditions on which notifications can be sent to the host server are listed below:

- Any monitored value exceeding a predefined or user-defined limit
- A digital input changing state (on/off)
- A digital output changing state
- An analog input transitioning into a warning or alarm region
- A scheduled update
- System faults
- SMS text commands from a user or host server
- Power on or reset

### 1.3.1 Event Codes

Every message sent by the Messenger W to a host-based server application is triggered by an event. The event generates a message and the message contains an Event Code. The Event Code uniquely identifies to the server the reason the message is being sent. Some of the messages generated contain data; others serve simply as notification that a particular event has occurred.

### 1.3.2 Store and Forward Data Queue

There are several scenarios where a message may not be deliverable – network down, host server down and poor connectivity, to name a few. In the event that a message cannot be delivered, it is stored in memory and is continually re-sent until it is properly acknowledged. This store and forward memory is non-volatile and remains intact during power off.

## 1.4 Specifications

|                         |                                                                                                                      |
|-------------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>Power Input:</b>     | 8-32 VDC<br>50 mA @ 24 VDC<br>Reverse polarity protection<br>Overvoltage protection<br>Externally fused              |
| <b>Digital Outputs:</b> | Transistor switch to ground (current sink)<br>2 A @ 24 VDC<br>Current limited<br>Overvoltage protection              |
| <b>Digital Inputs:</b>  | Two modes of operation (user selectable): voltage input or ground input<br>Current limited<br>Overvoltage protection |
| <b>Analog Input:</b>    | 10-bit ADC<br>Accuracy: +/- 2% FS<br>Input ranges (user selectable): 0-1 V, 0-5 V, 0-10 V, 0-20 mA                   |



## 2 Installation and Setup

This section provides information on installing the Messenger W and confirming its initial operation.



### **WARNING**

**IT IS RECOMMENDED THAT YOU READ THIS ENTIRE SECTION BEFORE STARTING THE INSTALLATION.**

### 2.1 Installation Steps

Installation consists of the following steps:

1. Unpack the Equipment.
2. Mount the Equipment.

The Messenger W should be mounted in a vertical position to try and minimize the chance of water entering through the antenna connection. The antenna wire should have a service loop just below the antenna connector.

3. Connect Main Power.
4. Connect Field Signals (digital, analog, Modbus) to the appropriate wire. Wiring information can be found in [Figure 2](#) and [Figure 3](#) in the [Diagrams](#) section.

### 2.2 Unpacking the Equipment

The Messenger W is shipped with the following:

- The Messenger W electronics in a Deutsch thermoplastic enclosure or a board-only product
- A Cellular antenna (magnetic mount or bulkhead)
- User Manual
- Optionally, a cable harness

### 2.3 Mounting the Equipment

The Messenger W is available in an automotive grade weather resistant enclosure; the dimensions of the enclosure are shown in [Figure 1](#).

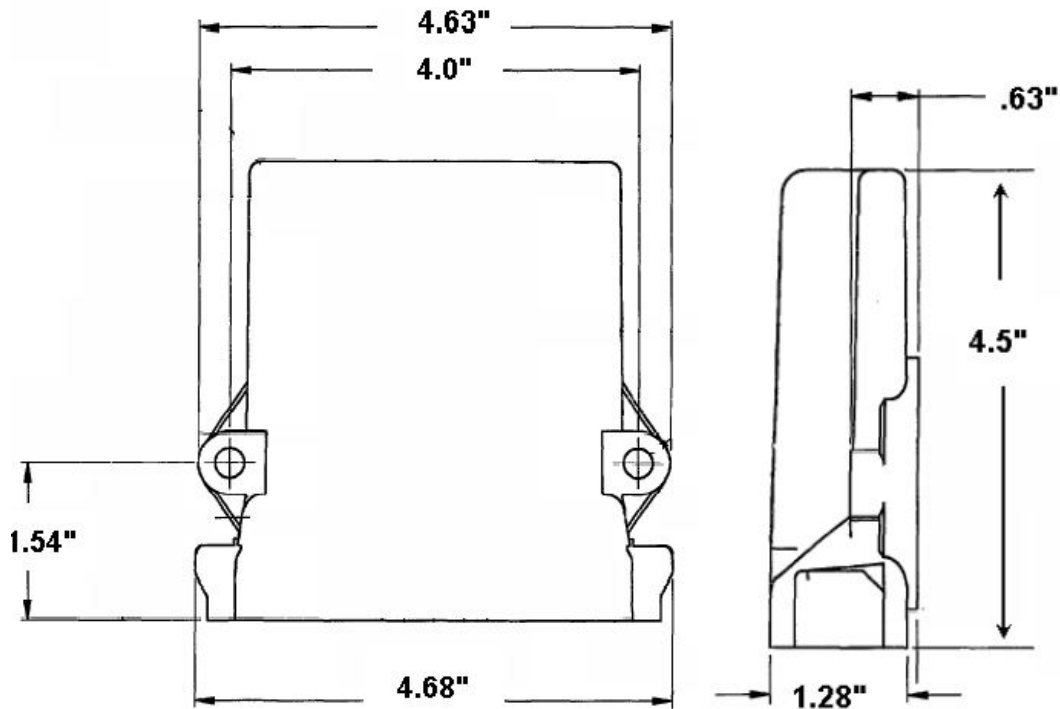


### **CAUTION**

**MOUNT THE MESSENGER W VERTICALLY AND PROVIDE A SERVICE LOOP FOR THE ANTENNA CABLE TO PREVENT WATER INTRUSION.**



### 2.3.1 EEC Thermoplastic Enclosure



**Figure 1: Deutsch EEC Thermoplastic Enclosure Dimensions**

### 2.4 Mounting the Antenna

The antenna shipped with the Messenger W is a cellular hockey puck style. The antenna can be ordered with a magnetic or a screw mount base.

In general, the antenna should be mounted with an unobstructed view of the sky. If the antenna is mounted outside and may be subject to lightning, a surge arrestor can be inserted between the antenna and the Messenger W. If the antenna is mounted inside, it should be located near a window.



**CAUTION**

SERVICE LOOPS SHOULD BE PROVIDED FOR THE ANTENNA CABLING, NEAR THE ANTENNA CONNECTION, TO MINIMIZE WATER INGRESS THROUGH THE CONNECTION.



### 3 LED States

There are eight LEDs used to indicate various system conditions. The locations of these LEDs can be seen in [Figure 2](#) in the [Diagrams](#) section. Specific information is conveyed to the user via LED blink patterns. On power-up, an LED test is performed by blinking all LEDs every second for 3 seconds. Following the LED test, the LEDs blink based on the following conditions.

#### LED 1 (GRN) – System

| State     | Rate                    | Definition                            |
|-----------|-------------------------|---------------------------------------|
| Blink     | 1 blink every 5 seconds | Sleep Mode                            |
| Blink     | 1 blink every second    | CPU Run – Normal                      |
| Blink     | 5 blinks every second   | Boot Loader Mode (all other LEDs off) |
| On or Off | Solid                   | System Failure                        |

#### LED 2 (RED) – Cell Registration

| State | Rate                  | Definition                                                   |
|-------|-----------------------|--------------------------------------------------------------|
| Blink | Rapid blink, then off | OK – Rx/Tx Activity with CELL Modem                          |
| Blink | 1 blink every second  | Not Registered<br>Check APN<br>Verify valid cellular account |
| Off   | Solid                 | OK – Registered                                              |

#### LED 3 (RED) – Cell Status

| State | Rate                   | Definition                                       |
|-------|------------------------|--------------------------------------------------|
| Blink | 10 blinks every second | No SIM card or communications failure with modem |
| On    | Solid                  | Not Ready/Fault                                  |
| Blink | 1 blink every second   | Error                                            |
| Off   | Solid                  | OK                                               |

#### LED 4 (RED) – CAN

| State | Rate                  | Definition                                            |
|-------|-----------------------|-------------------------------------------------------|
| On    | Solid                 | Fault, no engine bus activity detected                |
| Blink | 2 blinks every second | OBD traffic detected, but no response to data queries |
| Blink | 1 blink every second  | Engine bus not selected, check DIP Switch 2           |
| Off   | Solid                 | No Faults, engine bus activity detected               |



#### LED 5 (RED) – GPS

| State | Rate                 | Definition |
|-------|----------------------|------------|
| Blink | 1 blink every second | No Fix     |
| Off   | Solid                | Fix        |

#### LED 6 (RED) – Modbus

| State | Rate          | Definition                         |
|-------|---------------|------------------------------------|
| Blink | Rapid (burst) | OK – Rx/Tx Activity on Port 2 or 3 |
| On    | Solid         | Fault (comm. timeout error)        |
| Off   | Solid         | OK – No Faults                     |

#### LED 7 (RED) – USR1

| State | Rate                 | Definition                                                                                                                                        |
|-------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Blink | 1 blink every second | Lithium Coin Cell battery is low or RTC has stopped                                                                                               |
| On    | Solid                | If DIN1, DIN2, DIN3 or DIN4 are configured as pulse counter inputs, this LED will light when any input is activated; off when all inputs are idle |
| Off   | Solid                | No Faults                                                                                                                                         |

#### LED 8 (RED) – CELL Signal Strength

| Rate                    | Definition                       |
|-------------------------|----------------------------------|
| OFF                     | Not registered or not detectable |
| 1 blink, 1.2 sec pause  | signal strength <6, weak         |
| 2 blinks, 1.2 sec pause | signal strength <=12             |
| 3 blinks, 1.2 sec pause | signal strength <=18             |
| 4 blinks, 1.2 sec pause | signal strength <=24             |
| 5 blinks, 1.2 sec pause | signal strength >24, strong      |



## 4 Channels

The Messenger W maps all monitored conditions into channels. Each channel has data storage and configuration parameters. Data storage holds current value, max/min values, and other run time data values.

Every channel in the Messenger W is referenced by a fixed channel number; for example, the analog input channel is always channel 62. There is a set of predefined channels (numbers 1-300) and a set of Modbus channels (numbers 301-380). The Modbus channels are user configurable for reading/writing digital or analog values from a Modbus RTU slave device.

### 4.1 Defined Channels

The following channels are predefined in the Messenger W. The wiring for some of these channels can be found in [Figure 2](#) and [Figure 3](#) in the [Diagrams](#) section.

**Table 4.1: Predefined Channels**

| Channel Number                                             | Channel Name                                 | Type             | Description                                                                                                                              |
|------------------------------------------------------------|----------------------------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Start Digital Channels (data values are '0' or '1')</b> |                                              |                  |                                                                                                                                          |
| 1                                                          | Cell                                         | Digital (System) | Status of cellular modem operation<br>1 = fault<br>0 = normal                                                                            |
| 2                                                          | Comm                                         | Digital (System) | Status of any serial port used for communications with external device (MODBUS Master, Slave, or proprietary)<br>1 = fault<br>0 = normal |
| 4                                                          | User DIN1<br>(used for power fail detection) | Digital          | If SWX4-1 closed:<br>0 = input open<br>1 = input voltage < 1 VDC<br>If SWX4-1 open:<br>1 = input open<br>0 = input voltage > 3 VDC       |
| 21                                                         | User DIN2                                    | Digital          | If SWX4-2 closed:<br>0 = input open<br>1 = input voltage < 1 VDC<br>If SWX4-2 open:<br>1 = input open<br>0 = input voltage > 3 VDC       |



| Channel Number                                                                                | Channel Name        | Type    | Description                                                                                                                        |
|-----------------------------------------------------------------------------------------------|---------------------|---------|------------------------------------------------------------------------------------------------------------------------------------|
| 5                                                                                             | User DIN3           | Digital | If SWX4-3 closed:<br>0 = input open<br>1 = input voltage < 1 VDC<br>If SWX4-3 open:<br>1 = input open<br>0 = input voltage > 3 VDC |
| 6                                                                                             | User DIN4           | Digital | If SWX4-4 closed:<br>0 = input open<br>1 = input voltage < 1 VDC<br>If SWX4-4 open:<br>1 = input open<br>0 = input voltage > 3 VDC |
| 30                                                                                            | User DOUT1          | Digital | State of digital output 1<br>0 = not energized<br>1 = energized                                                                    |
| <b>Start Analog Channels (data values are floating point, precision is user configurable)</b> |                     |         |                                                                                                                                    |
| 62                                                                                            | User Analog         | Analog  | Onboard analog input, 10-bit ADC can be configured for 0-1 VDC, 0-5 VDC, 0-10 VDC, or 0-20 mA                                      |
| 154                                                                                           | Daily Flow Volume   | Derived | Accumulated flow volume for the day (flow rate from ADC input)                                                                     |
| 155                                                                                           | Running Flow Volume | Derived | Accumulated flow volume since last volume reset (flow rate from ADC input)                                                         |

## 4.2 Channel Data

All values read from physical IO or from a Modbus slave device are continually updated and tested as defined by the configuration parameters. For each channel, based on its type (analog or digital), there is a basic set of data collected. For purposes of discussion, the term “not normal” is used to indicate an analog value that has violated a limit threshold or a digital value that does not match its configured ‘normal’ state.

Basic Data Set –

For the analog channel:

- Current value
- Max/min values (daily and trip)



For the digital channels:

- Current value
- Previous value
- Count of transitions to not normal (counts)
- Accumulated time in not normal state (duration)

There are a few channels that can be configured for special functions. All the physical digital input channels can accept pulse inputs (e.g., from a flow meter) and the physical analog input can be used to totalize volume when the input is flow rate. These channels have an extended data set.

Extended Data Set –

For the analog channel:

- Daily total volume (available on separate channel, 154)
- Continuous running total volume (available on separate channel, 155)

For the digital channels:

- Flow rate
- Daily total volume
- Continuous running total volume

The Messenger W also maintains a set of daily data.

The daily data set is a separate set of current and max/min values that span the 24 hour period from midnight to midnight, UTC time. At midnight, an end of day report is generated from this data.

Because Modbus channel data is polled, Modbus digital channels do not maintain count or duration values.



## 5 SMS Text Commands

The Messenger W can receive and execute SMS commands to perform several functions. The SMS command set includes the following:

- ACTION – on-demand action request

### 5.1 Command Syntax

The commands can be upper case, lower case or a combination, as illustrated here:

- **<ACTION(x)>** - request to execute action identified by action number  
**x** = action number, as defined below

#### Action Commands

| Action Number | Action Description                                  | Response     |
|---------------|-----------------------------------------------------|--------------|
| 1             | Generate on-demand standard report to host server   | ack + report |
| 2             | Return status to sender                             | status       |
| 3             | Force cell modem reset                              | ack          |
| 4             | Clear all stored data records                       | ack          |
| 5             | Return Cell config to sender                        | cell config  |
| 6             | Force digital output 1 on                           | ack          |
| 7             | Force digital output 1 off                          | ack          |
| 8             | Generate on-demand end of day report to host server | ack + report |
| 10            | Return a subset of channel data values to sender    | data values  |
| 13            | Clear oldest data record                            | ack          |
| 26            | Force exit of mini-ping mode                        | ack          |
| 28            | Zero all non-volatile counter data                  | ack          |
| 30            | Return SIM card info                                | SIM info     |
| 32            | Clear ADC channel daily flow totals                 | ack          |
| 33            | Clear ADC channel running flow totals               | ack          |



Action Responses:

ack text:

v: r: c

status text:

VID(v)-CELL(i s)-REG(r g)-RSSI(#)-GPS(p)-JBUS(j m n)-DATAQ(d e f)-OUTP(a b)-SWX(x)-MSGs(f c)-  
VER(v#.#.# date prot modem jbus)

VID: v = vehicle ID

CELL: i = init state  
s = current state

REG: r = tower registration  
g = data registration

RSSI: # = signal strength

GPS: p = 1 for fix, 0 for no fix

JBUS: j = J1939, J1708, OBD2  
m  
n

DATAQ: d = count in queue  
e = deleted from queue  
f = failed

OUTP: A  
B

SWX

MSGs: f = failed  
c = count

VER: prot = protocol (Antx, Rastrac, other)  
modem = type of modem  
jbus = type of bus

SIM info text:

VID(v)-MSISDN(s)-ICCID(g)-IMSI(u)-IMEI(p)

data text:

VID v-Running: s-52 RPM: r-x Hours: h- CoolTemp: x-Battery -OilPress -Odometer o

generator control text:



## 6 Diagrams

These figures provide some additional details concerning the wiring and LED locations in the Messenger W.

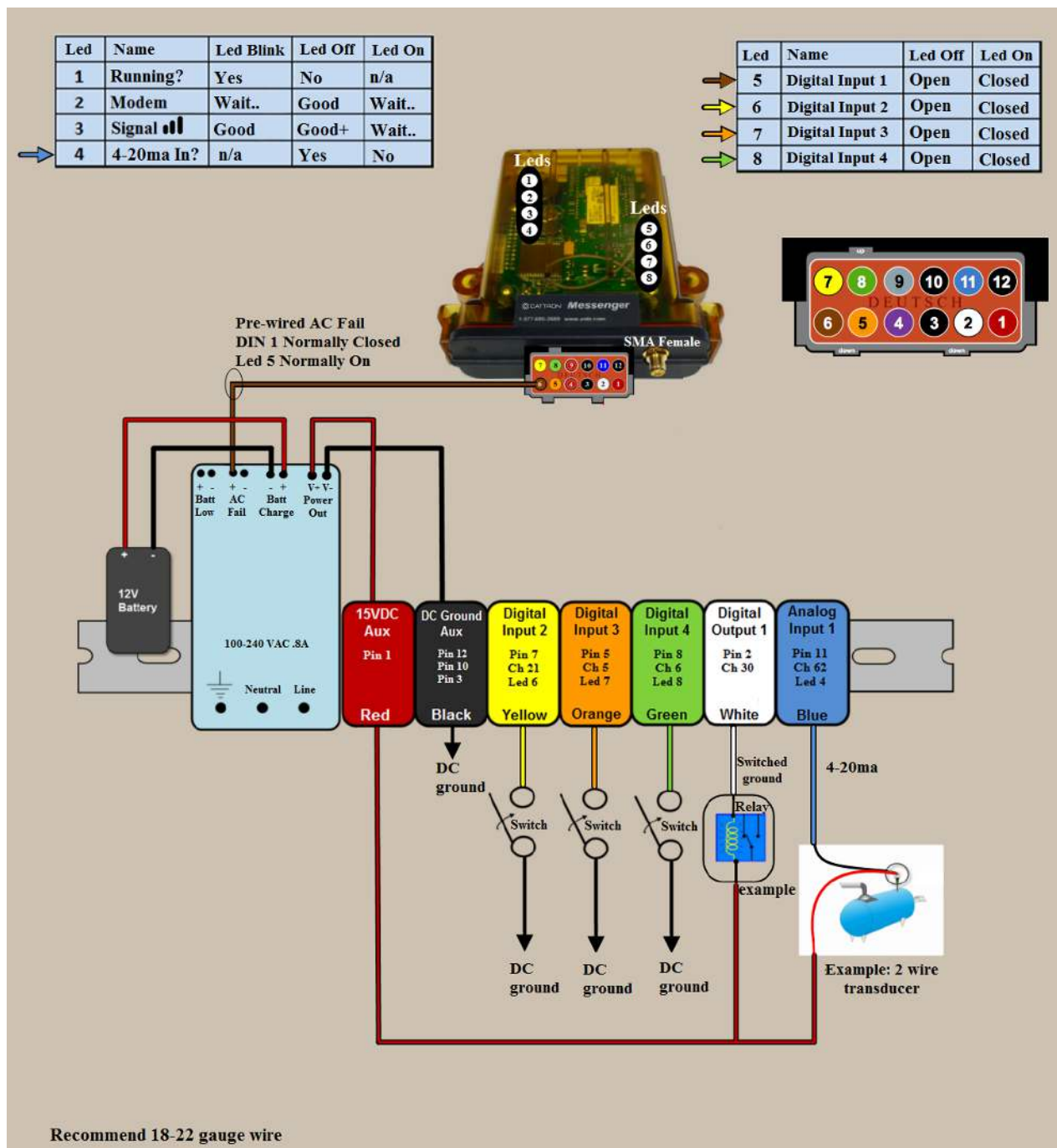


Figure 2: LED Locations and Wiring Information



## Water Messenger Wiring

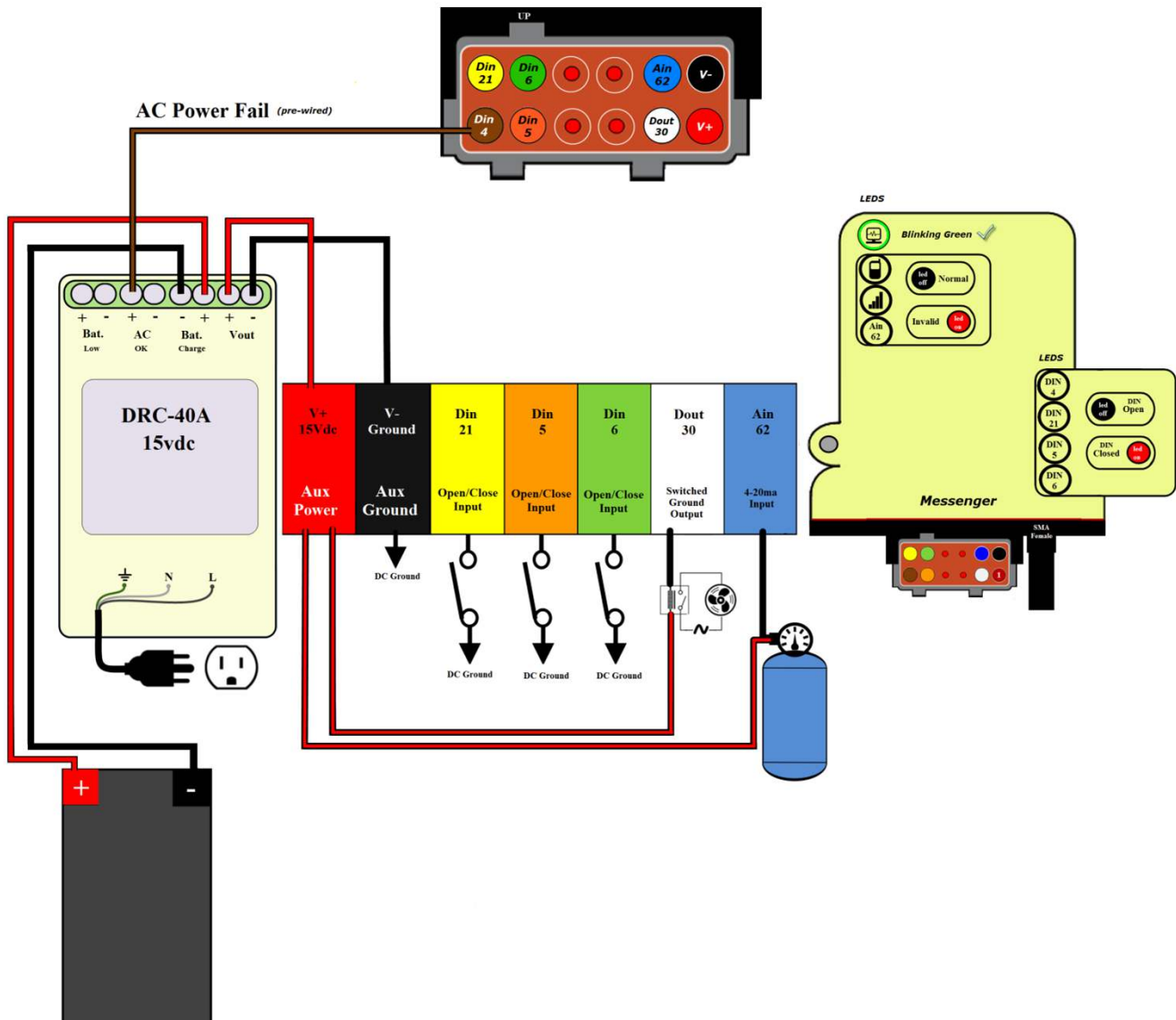


Figure 3: Messenger W Wiring Details



## 7 Technical Support

For remote and communication control systems support, parts and repair, or technical support, visit us online at:  
[www.cattron.com/contact](http://www.cattron.com/contact).



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