



SOLUTIONS CUBED

## ICON Communication Module Data Sheet

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**1. Revision Log – Electrical / Mechanical Specifications**

<b>Date</b>	<b>Rev</b>	<b>Description</b>	<b>By</b>
3-23-03	1	Original Implementation	L. Glazner

**2. Introduction**

**ICON Communication Module  
RS232 and/or RS485 Bus Construction Module**

**FEATURES**

- ◆ Communication translator for quick construction of serial data buses
- ◆ RS232 to/from TTL conversion for serial data
- ◆ RS485 to/from TTL conversion for serial data
- ◆ RS232 to/from RS485 conversion for serial data

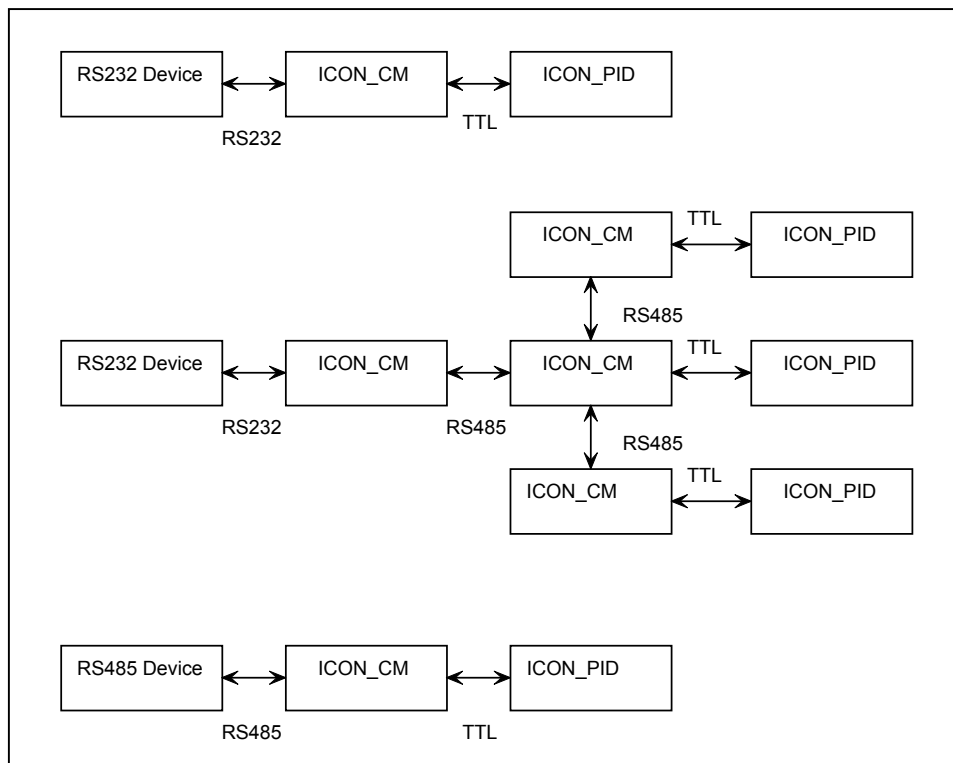
**2.1 DESCRIPTION**

The ICON Communication Module (ICON\_CM) is designed to simplify testing and development of projects requiring RS232 or RS485 serial communication level conversion. These versatile modules can convert serial communication signals to or from RS232, RS485, and TTL levels.

At the time that this datasheet was written the device can be mounted directly to the ICON Interface Module (ICON\_IM), ICON Position Controller (ICON\_PID), or the Mini PID Position Controller (MPID) using supplied stand-offs and ribbon cable hardware. This product is also capable of interfacing to other Solutions Cubed products, or can be used as a stand-alone level converter for custom designs.

Pricing in single unit quantities is \$59.

**Figure 1: Communication Bus Examples**



### 3. Engineering Specifications

#### 3.1 Absolute Maximum Ratings

*These are stress ratings only. Stresses above those listed below may cause permanent damage and/or affect device reliability. The operational ratings should be used to determine applicable ranges of operation.*

Storage Temperature	-55°C to +150°C
Operating Temperature	0°C to +70°C
Supply Voltage	-0.3V to 5.5V
Voltage on RS232 connections	-13V to +13V
Voltage on RS485 connections	-7V to +7V
Voltage on all other connections	-0.3V to 5.5V

#### 3.2 Electrical Characteristics

At T<sub>A</sub> = 25°C, Supply Voltage = +5V

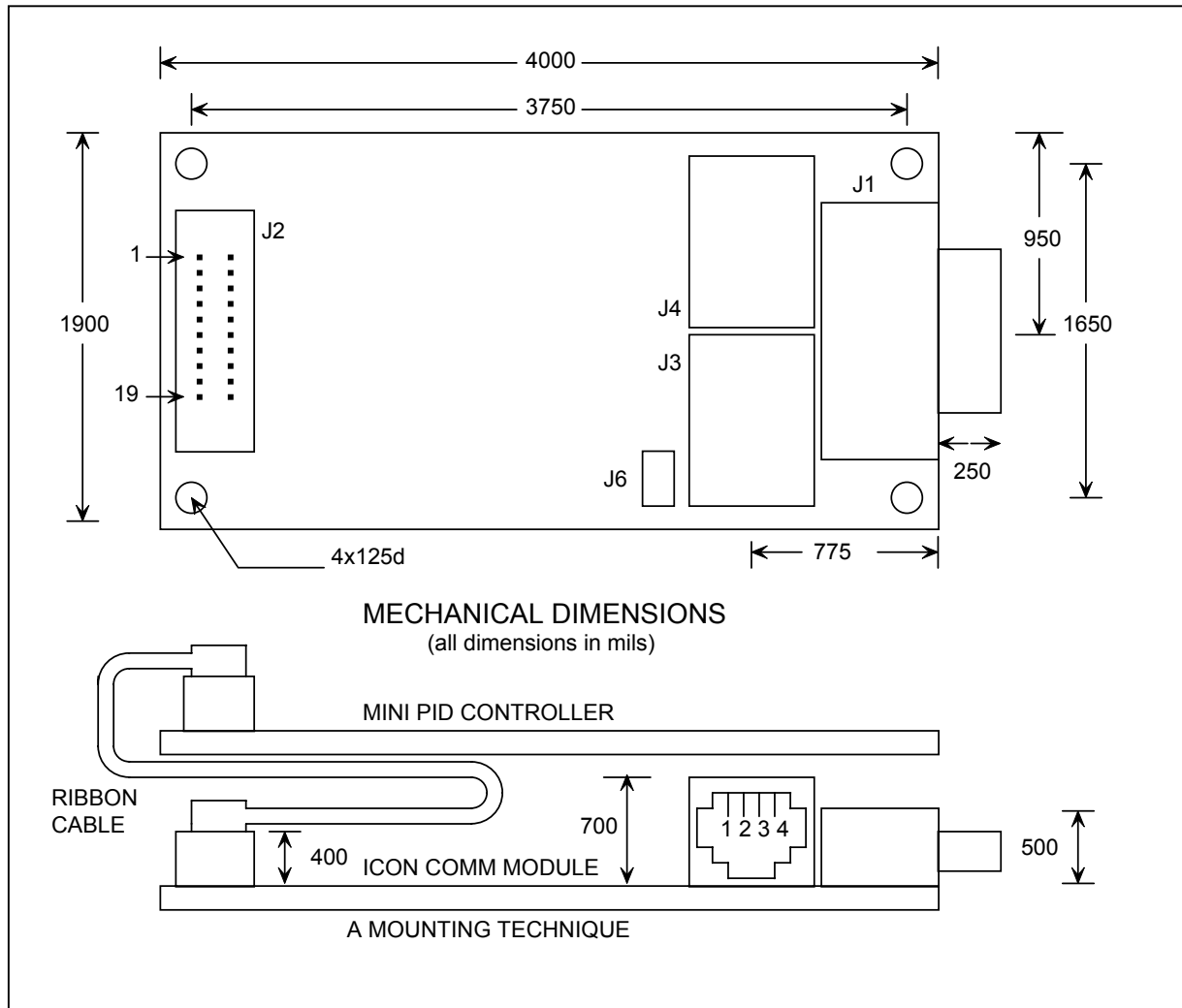
Characteristic	Min	Typ	Max	Unit	Notes
Supply Voltage	4.5		5.5	V	
Supply Current			20	mA	
Low Level Input RS232_IN pin		0.8		V	
High Level Input RS232_IN pin		2.4		V	
RS232_IN allowable voltage range	-30		+30	V	
RS232_OUT pin voltage range	+/- 5		+/- 10	V	
Low Level Input TTL_IN pin		0.9		V	
High Level Input TTL_IN pin		2.0		V	
Low Level Output TTL_OUT pin		0.4		V	
High Level Output TTL_OUT pin		3.5		V	
Low Level Input RS485 Differential Voltage (RS485_A-RS485_B)			0.4	V	
High Level Input RS485 Differential Voltage (RS485_A-RS485_B)	3.5			V	
Maximum Data Rate	38.4	76.8		KBPS	Not tested above 38.4KBPS
Number of RS485 Transceivers per bus	2		32	NA	

note: "Typ" values are for design guidance only and are not guaranteed

**3.3 Mechanical Dimensions**

The ICON Communications Module can be mounted to many Solutions Cubed products. One example is shown below. The +5VDC power is applied through J2, J3, or J4.

**Figure 2: Mechanical Dimensions**



**Figure 3: Mechanical Landmark Descriptions**

Landmark	Type	Description
J1	DB9 female	RS232 connector connects directly to a PC serial port.
J2	2x10 shrouded header	TTL level communication lines are available at this header. This part matches the header connections of many Solutions Cubed products.
J3	4 conductor modular jack	This side mounted modular jack can be used with standard 4 conductor phone cable to link RS485 modules.
J4	4 conductor modular jack	This side mounted modular jack can be used with standard 4 conductor phone cable to link RS485 modules.
J6	2 pin header	Located on REV2 and greater PCB. This header may be used with a jumper to connect the +5V connection from this board to J3 and J4. On the REV1 PCB this is done solely with R10.

### 3.4 Connectivity

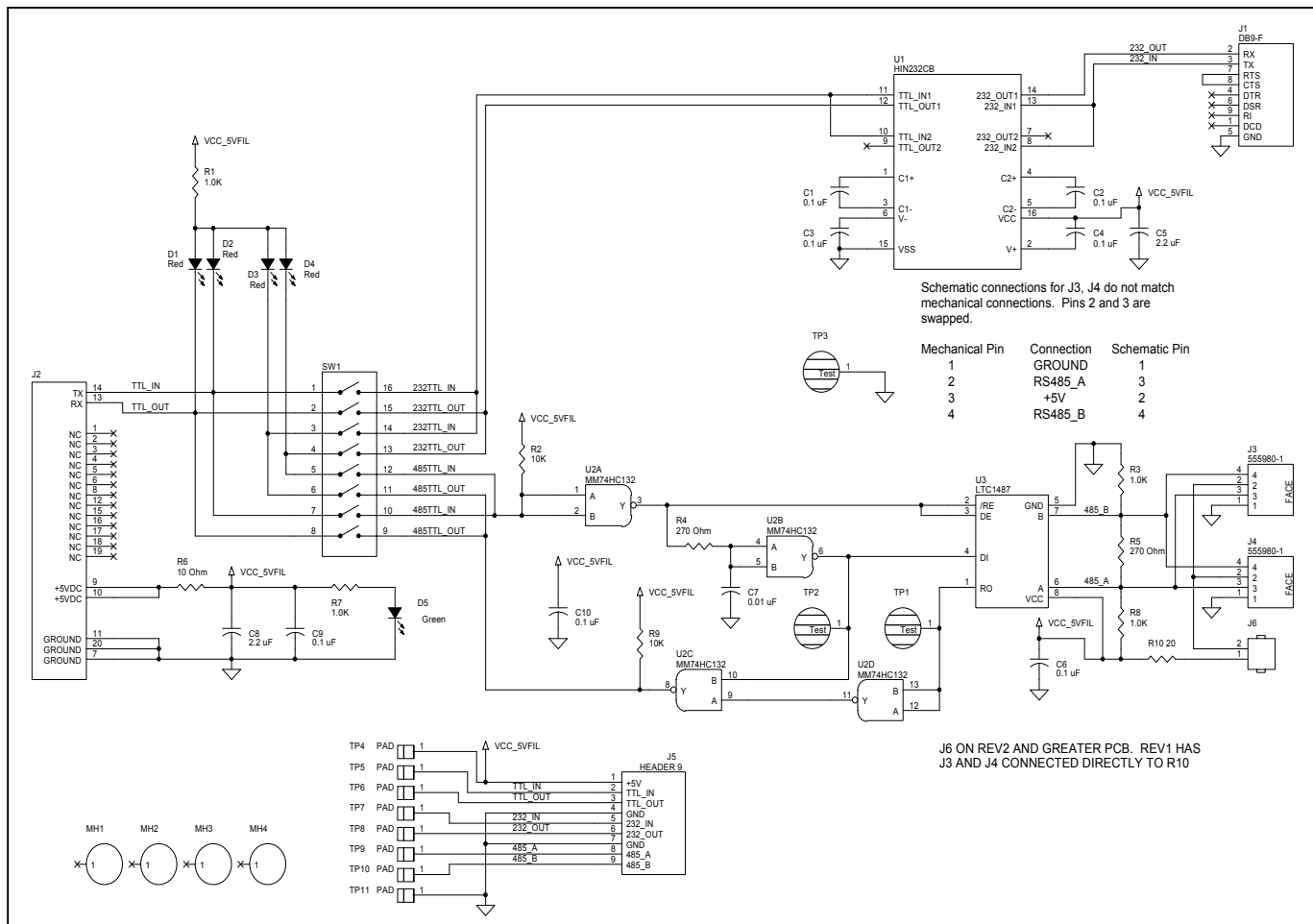
TTL level connections are made at J2, RS232 connections are made at J1, and RS485 connections are made at J3 and J4. Accommodations have been for power to be supplied through J2, J3, or J4. However, if long wiring runs or separate power supplies are connected to different ICON Communication Modules operating in RS485 mode it may be necessary to remove the jumper at J6. For the REV1 PCB it may be required to remove R10.

The SW1 settings for various modes of operation are displayed on the ICON Communications Module PCB. LED communication activity indicators are also detailed on the PCB.

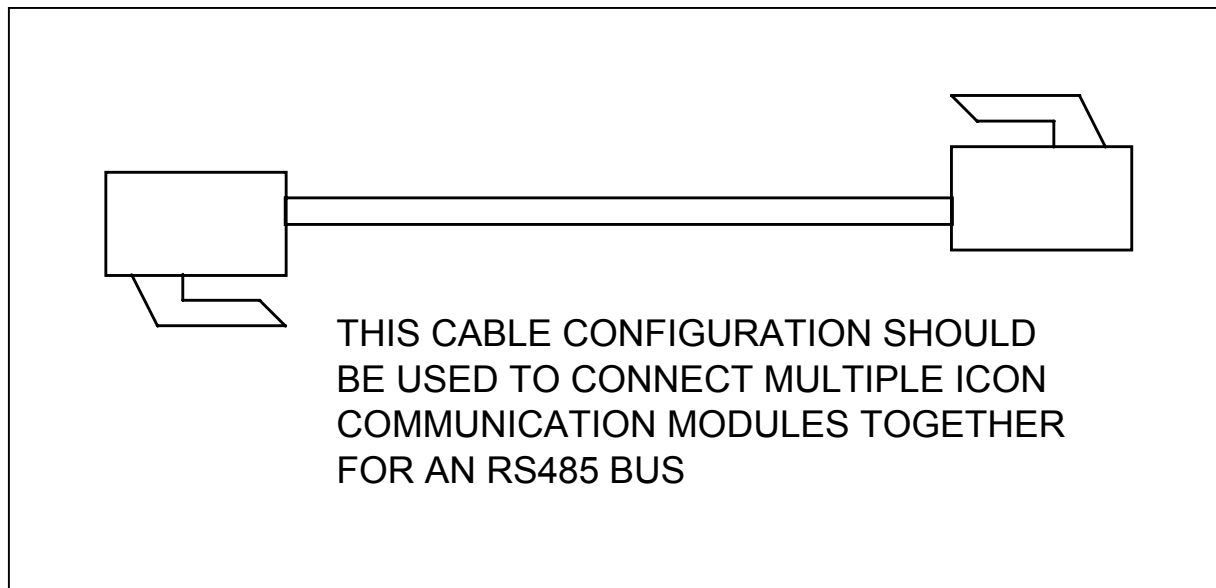
The RS485 circuitry has been designed to operate in a continuous receive mode. The RS485 driver enters drive mode only when a logic low (0V) is applied to the input of the RS485 circuitry. Using the logic circuitry associated with the RS485 connection there is no on-board intelligence required to place the RS485 transceiver in either transmit or receive modes. An additional effect of this circuitry is to reduce the width of low-level (0V) signals passed to the RS485 bus. This can effectively reduce the maximum operating speed of the serial data on the RS485 bus. The ICON Communications Module is tested to 38.4KBPS, but may operate at higher levels.

J5 is not loaded on the PCB but can be used to connect test points or for custom connections.

**Figure 4: ICON Communication Module Schematic**



**Figure 5: RS485 Cable Configuration**



**3.5 Connector Pin Outs and Pin Descriptions**

Connector – Pin Numbers	Description
<b>J1 – DB9 Female</b>	
2	RX – RS232 output from ICON_CM
3	TX – RS232 input to ICON_CM
7,8	RTS and CTS tied together on PCB
5	GROUND
1,4,6,9	No connections
<b>J2 – 2 x 10 0.1” shrouded header</b>	
13	RX – TTL output from ICON_CM
14	TX – TTL input to ICON_CM
9,10	+5VDC - +5V power to ICON_CM
7,11,20	GROUND
1,2,3,4,5,6,8,12,15,16,17,18,19	No connections
<b>J3 and J4 – 4 pin modular jack</b>	Mechanical connections are shown
1	GROUND
2	RS485_A – connects to external RS485_A pins
3	+5VDC
4	RS485_B - connects to external RS485_B pins
<b>J6 – 2 pin 0.1” header</b>	Only on REV2 PCBs and higher
1,2	Add jumper to connect +5V bus of ICON_CM to +5VDC pins of J3 and J4.

## 4. Overview

The ICON Communication Module can be used to convert between three different serial communication electrical specifications. The conversion circuitry is accessed by connecting electrical paths by setting the DIP switch SW1 to allow for the various conversion configurations. The DIP switch settings allow for three modes of operation and only these three settings should be used. Additionally, the DIP switch settings should only be changed when the ICON Communication Module is not powered.

When building an RS485 communication bus each node must have a different address. Otherwise all devices on the bus will attempt to respond to communication at the same time. Many Solutions Cubed products allow for programmable address values. These products should be programmed with different address values prior to connection to the RS485 bus.

**Figure 6: DIP Switch Settings**

DIP Switch #	Mode 1: RS485 <> TTL	Mode 2: RS232 <> RS485	Mode 3: RS232 <> TTL
1	OFF	OFF	ON
2	OFF	OFF	ON
3	OFF	ON	OFF
4	OFF	ON	OFF
5	OFF	ON	OFF
6	OFF	ON	OFF
7	ON	OFF	OFF
8	ON	OFF	OFF

### 4.1 RS232 <> TTL Conversion

The ICON Communication Module may be used to convert RS232 level serial communication (a PC serial port outputs RS232 levels) to TTL levels (0V = logic “0” while +5V = logic “1”). RS232 serial communication is attached through the female DB9 connector J1, which is compatible with a PC serial port using a standard DB9 cable. TTL level serial communication lines are available at J2 and match the serial communication connections of many Solutions Cubed products. In this mode of operation power should be applied through the +5VDC connections at J2.

### 4.2 RS232 <> RS485 Conversion

The ICON Communication Module may be used to convert RS232 level serial communication (a PC serial port outputs RS232 levels) to RS485 levels (typically a 0V to 5V signal where a differential voltage level (channel A – channel B) relates to a logic “0” or “1”). RS232 serial communication is attached through the female DB9 connector J1, which is compatible with a PC serial port using a standard DB9 cable. An RS485 communication bus allows for parallel connections where a large number of “nodes” can be attached. The RS485 connections are made at J3 and J4 via a four conductor modular jack. This connection matches standard phone cables available at your local hardware or electronics supply stores. The cable connection should match that shown on figure 5. Essentially you want RS485\_A of one node to connect to RS485\_A of the next node. Likewise with RS485\_B, GROUND, and +5VDC. For this type of conversion power is applied through either J3 or J4. R10 allows for some difference in the 5V supply connected to J3 and J4, but for long wiring runs this resistor may need to be removed (on REV2 and higher PCBs J6 is in place to allow a jumper to select whether or not 5V is supplied via J3 and J4).

### 4.3 RS485 <> TTL Conversion

The ICON Communication Module may be used to convert TTL levels (0V = logic "0" while +5V = logic "1") to RS485 levels (typically a 0V to 5V signal where a differential voltage level (channel A – channel B) relates to a logic "0" or "1"). TTL level serial communication lines are available at J2 and match the serial communication connections of many Solutions Cubed products. In this mode of operation power should be applied through the +5VDC connections at J2. The RS485 connections are made at J3 and J4 via a four conductor modular jack. This connection matches standard phone cables available at your local hardware or electronics supply stores. The cable connection should match that shown on figure 5. Essentially you want RS485\_A of one node to connect to RS485\_A of the next node. Likewise with RS485\_B, GROUND, and +5VDC. For this type of conversion power is available through either J3 or J4. R10 allows for some difference in the 5V supplies connected to J2, J3 and J4, but for long wiring runs this resistor may need to be removed (on REV2 and higher PCBs J6 is in place to allow a jumper to select whether or not 5V is supplied via J3 and J4).

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