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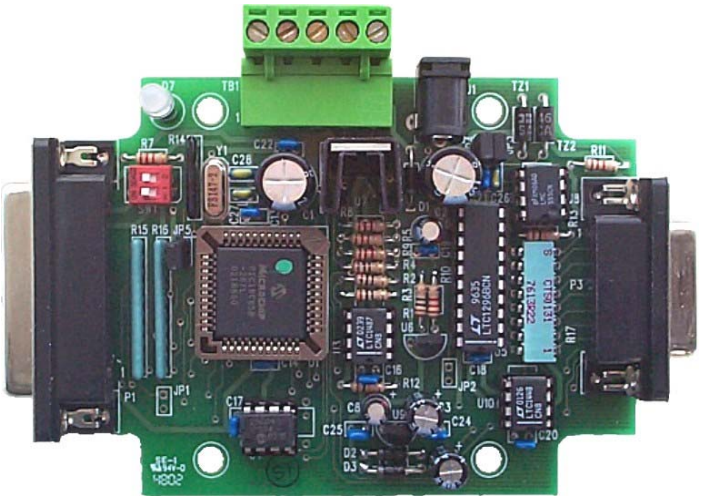


485M300 Series I/O Modules

Digital I/O
Analog I/O

Table of Contents

Introduction

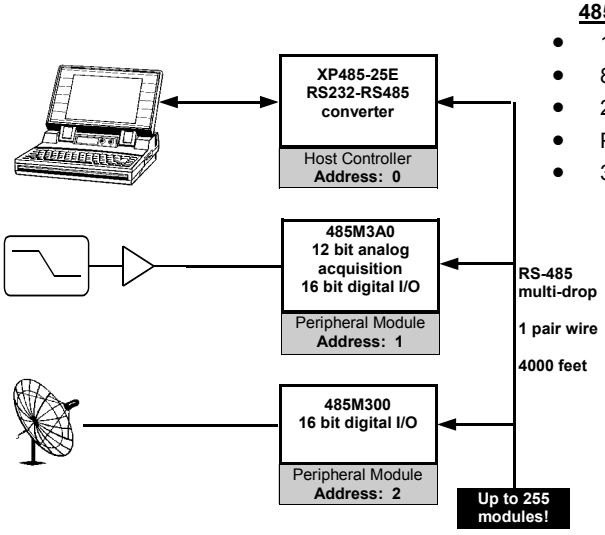
Welcome to the Integrity Instruments **485M300 Series** of I/O modules. These modules using RS-485 communications are available in different configurations dependent on your needs and applications. In addition they are offered in an enclosure, or open allowing you the end user complete flexibility when determining the parameters for your project.

Configurations for 485M300 models with enclosure are

485M300CE	16 digital I/O
485M3A0CE	16 digital I/O and 8 channels A to D conversion
485M3ADCE	16 digital I/O and 8 channels A to D conversion and 2 channels D to A conversion

I/O Module features:

MPU:	Microchip PIC16C65B
EEPROM:	Microchip 25C040
MPU Clock:	14.7456 Mhz
Interface:	RS-485 (multidrop up to 255 nodes)
Baud:	9600, 19200, 57600, 115200 (DIP switch selectable)
LED:	Bicolor diagnostic LED
Watchdog:	MPU has built-in watchdog timer
POR:	MPU contains timed Power On Reset circuitry
Brownout:	MPU brownout detection ciruictry built-in
Temperature:	0° to 70°C (32° to 158°F) *Commercial Temperature Range* -40° to +85°C (40° to 185°F) *Industrial Temperature Range*
PCB:	FR4
Power:	7.5Vdc to 15.0Vdc, approximately 50 ma.



485M300 Series Features

- 16 Digital I/O lines
- 8 12 bit Analog Inputs
- 2 12 bit Analog Outputs
- PWM Output
- 32 bit Pulse Counter 1 Mhz

Quick Start Instructions

You need the following:

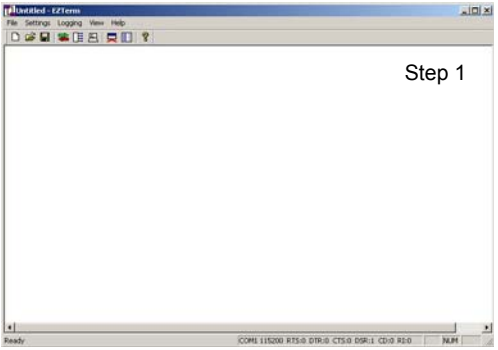
- EZTerminal program available **free** on our website http://**www.integrityusa.com**
- An open COMPORT on your PC
- Power supply PS9J (9VDC 400 ma unregulated)
- A cable to connect your PC to your **485M300** I/O module
- If you use your com port you need a **XP485-25E** RS-232 to RS-485 converter

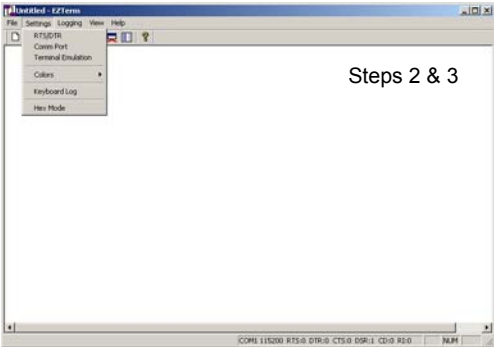
Make these DIP switch settings for 115,200 baud

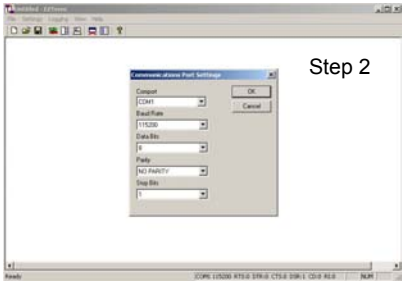
SW1: ON
SW2: ON (These are **factory default** settings, see page 22)

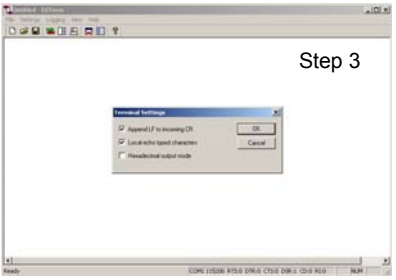
Launch the EZTerminal program

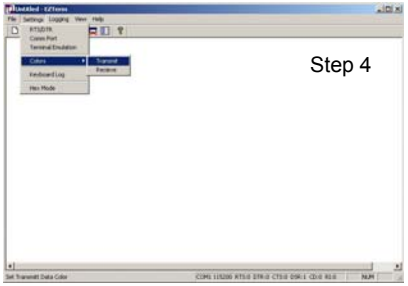
1. Double click the icon in whatever area you have put the program.
2. Under "**Settings**" then choose Comport and select your RS-232 port, 115,200 Baud Rate, 8 Data Bits, NO PARITY, and 1 Stop Bits.
3. Under "**Settings**" now choose "**Terminal Settings**", and check the "**Append LF to incoming CR**" box, and "**Local echo typed characters**" check box.
4. You may change the color of the transmitted and received characters by going under "**Settings**" and selecting "**Colors**" then "**Transmit**" or "**Receive**" and pick the color of your choice.

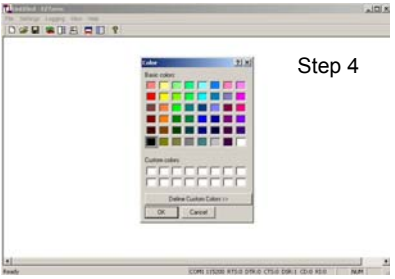












Your First Command

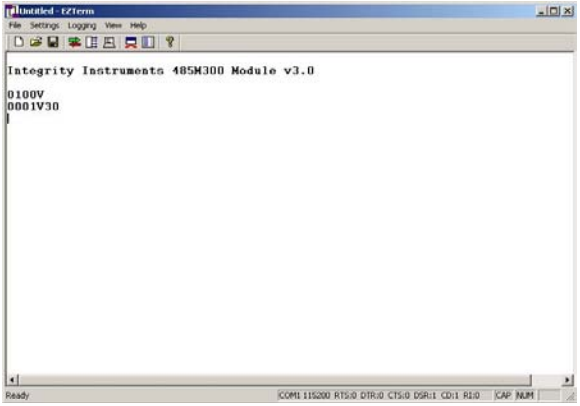
Now that you have a EZTerminal session running, your ready to power up the **485M300 Series** I/O Module. After powering up your **485M300 Series** Module, EZTerminal will receive a welcome message from the unit indicating you are ready to provide your first command.

RS-485 Firmware Version Command:

- Type **0100V** and the **Enter Key**
- You should see 0001V30 on the screen
- **NOTE:** Make sure to type **CAPITAL V**, not lowercase v!

After your first command, see **Commands and Responses** section for more commands.

Screenshots and setup instructions performed running EZTerminal on a PC installed with Microsoft® Windows® XP Operating System.

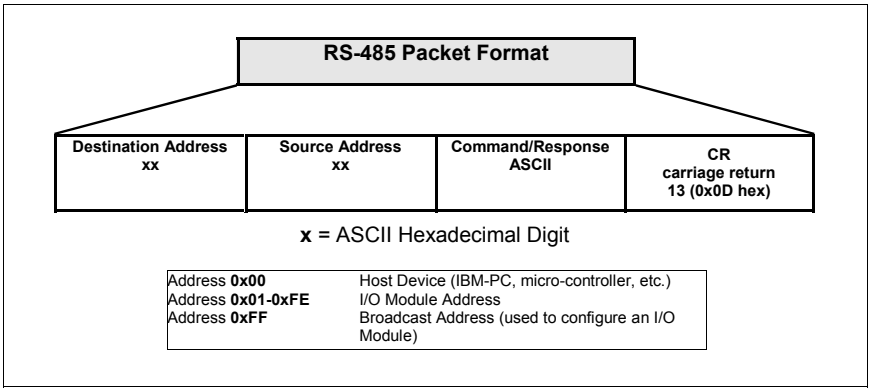


Communications

The Integrity Instruments **485M300 Series** modules use RS-485 as the communications interface. The interface uses simple **ASCII** commands. A carriage return **(decimal code 13 or Hex code 0x0D)** marks the end of a data packet. Line feeds **(decimal code 10 or Hex code 0x0A)** are ignored.

RS-485 Interface:

- RS-485 operates Half Duplex
- Each module (node) on the bus has a unique Address 1 to 254 (0x01-0xFE hex)
- We use the Linear Technologies® RS-485 bus drivers (LTC1487) allowing up to **256 nodes** on the RS-485 multi-drop bus
- Address 0 (0x00 hex) is reserved for the Host controller
- Address 255 (0xFF hex) is reserved for Broadcast messages. **Address 0xFF is ccepted by all modules on the RS-485 bus.**



Commands and Responses

The following table illustrates the Integrity Instruments I/O module commands and responses.

NOTE

- All numeric data is represent as **ASCII Hexadecimal integers** (value **x/y** in the table)
- If a module receives an illegal or improperly formatted command, Error Response is sent.
- All ASCII characters are **CASE SENSITIVE** (use all capital letters!)

Commands and Responses v3.0 Firmware

Command Sent by Host	**Response** Sent by I/O Module	**Description**
V	Vxy	Firmware version x.y
I	Ixxyy	Input digital port status xx = PORT1 yy = PORT2 ***Also returns current output port status***
Oxxyy	O	Output digital port: xx = PORT1 yy = PORT2
Txxyy	T	Set digital direction: xx = PORT1 yy = PORT2 bit set(1) = Input, bit clear(0) = Output
G	Gxxyy	Get current digital direction: xx = PORT1 yy = PORT2 bit set(1) = Input, bit clear(0) = Output
N	Nxxxxxxxx	Get Pulse Counter (xxxxxxxx 32 bit counter value)
M	M	Clear Pulse Counter
Qy	Qyxxx	Bipolar sample analog (y control nibble, xxx analog value)
Uy	Uyxxx	Unipolar sample analog (y control niblle, xxx analog value)
Lyxxx	L	D/A output y (channel setting 0 or 1), xxx 12 bit D/A output)
K	Kxx	Get receive error count (xx current count)
J	J	Clear receive error count
Pxxyyy	P	PWM (xx = PWM frequency, yyy = PWM duty)
Wyyxx	W	Write EEPROM (yy address, xx value)
Ryy	Rxx	Read EEPROM (yy address in command, xx value in reponse)
Z	Z	Reset CPU
	X	**Command error response**

RS-485 Interface Example Commands
The following table illustrates actual command and response data for an RS-485 interface.

NOTE

- All numeric data is represent as ASCII Hexadecimal integers
- Example **Host Address** = 0x00 and **Module Address** = 0x13
- The symbol ↵ equates to a carriage return (decimal 13, hex 0x0D)

Command Sent by Host	**Response** Sent by I/O Module	**Description**
1300V↵	0013V30↵	Module Firmware version 3.0
1300I↵	0013IFF00↵	Input digital port [PORT1 bits0-7 ON] [PORT2 bits0-7 OFF] **Note:** this command also returns the current digital output
1300O007F↵	0013O↵	Output digital port [PORT1 bits 0-7 OFF] [PORT2 bit 7 OFF, bits 0-6 ON]
1300TFF80↵	0013T↵	Set digital direction [PORT1 bits 0-7 INPUT] [PORT2 bit 7 INPUT, bits 0-6 OUTPUT]
1300G↵	0013GFF80↵	Get current digital direction [PORT1 bits 0-7 INPUT] [PORT2 bit 7 INPUT, bits 0-6 OUTPUT]
1300N↵	0013N0000000F↵	Get pulse counter: Current count = 15
1300M↵	0013M↵	Clear pulse counter: Current count = 0
1300Q1↵	**0013Q1**00F↵	Bipolar analog control nibble = 0x1 Analog reading = 0x00F
1300U8↵	**0013U8**40F↵	Unipolar analog control nibble = 0x8 Analog reading = 0x40F
1300L1800↵	0013L↵	D to A Output Channel 1 = 2.5 Volts
1300K↵	0013K00↵	Current receive errors = 0
1300J↵	0013J↵	Clear receive error count: Current receive
1300P4801F↵	0013P↵	PWM freq = 50499 Hz, PWM duty = 10.6%
1300W0410↵	0013W↵	Write EEPROM Address 0x04 with value 0x10
1300R04↵	0013R10↵	Read EEPROM Adress 0x04 (value is 0x10)
1300Z↵	0013Z↵	Reset CPU (forces a watchdog timeout after

Analog Control Nibble and Example

The **485M300 Series** modules utilizes the Linear Technologies LTC1296 analog to digital conversion chip. In the process of performing a data sample, the user sends a control nibble to the **485M300** module. The module in turn performs a data conversion using the control nibble and transmitts a response data sample back. The following table lists each of the 16 possible analog configurations.

NOTE

- All numeric data is represent as ASCII Hexadecimal integers
- The symbol ↵ equates to a carriage return (decimal 13, hex 0x0D)
- See **Technical Info** section for sample to volts conversion

Control Nibble Sent by Host	**Analog Sample**
0	Differential: CH0+ CH1-
1	Differential: CH2+ CH3-
2	Differential: CH4+ CH5-
3	Differential: CH6+ CH7-
4	Differential: CH0- CH1+
5	Differential: CH2- CH3+
6	Differential: CH4- CH5+
7	Differential: CH6- CH7+
8	Single Point: CH0
9	Single Point: CH2
A	Single Point: CH4
B	Single Point: CH6
C	Single Point: CH1
D	Single Point: CH3
E	Single Point: CH5
F	Single Point: CH7

Command Sent by Host	**Response** Sent by I/O Module	**Description**
1300Q0↵	Q000F↵	Bipolar sample differential CH0+ CH1- (Control = 0) Analog sample = 0x00F (decimal 15)
1300UA↵	UA123↵	Unipolar sample CH4 (Control = A) Analog sample = 0x123 (decimal 291)

EEPROM Map:

Address	Description
0x00	Module Address (RS-485 address) **[factory default = 0x01]**
0x01	N/A - Reserved
0x02	Data Direction Port 1 Bit set (1) = Input Bit clear (0) = Output **[factory default = 0xFF]**
0x03	Data Direction Port 2 Bit set (1) = Input Bit clear (0) = Output **[factory default = 0xFF]**
0x06	Port 1 Power on Default output **[factory default = 0x00]**
0x07	Port 2 Power on Default output **[factory default = 0x00]**
0x08 *See Note 1*	Expander board flag (Opto-22 modules attached) 0x00 = No expander board attached 0xFF = Expander board attached (invert digital signals) **[factory default = 0x00]**
0x09/0x0A	D/A Channel 0 Power on Default output 12 bits - upper nibble in 0x09, lower byte in 0x0A **[factory default = 0x000]**
0x0B/0x0C	D/A/ Channel 1 Power on Default output 12 bits - upper nibble in 0x0B, lower byte in 0x0C **[factory default = 0x000]**
0x0D *See Note 2*	A/D Channels sample clock rate 0x00 = Normal A/D Channels sample clock rate 0xFF = Slowed A/D Channels sample clock rate **[factory default = 0x00]**
0X04, 0X05, 0x0E, 0x0F	N/A - Reserved
0x10….0xFF	Available to User

WARNING!
The I/O Module CPU must be reset before new EEPROM settings take effect.

NOTE
1. This flag is used when an expander board is attached. It allows for polarity interface to the industry standard I/O modules used with the expander board based on open collector logic that these modules use.
2. This is used to slow the A/D Channel sample clock rate. This may help when the A/D channels have a high impedance input attached.

Analog& Digital I/O Sampling Rates

Analog I/O		
Baud Rate	**Delayed Response**	**No Delayed Response**
115,200	141	486
57,600	123	257
19,200	62	89
9600	37	45
Digital I/O		
Baud Rate	**Delayed Response**	**No Delayed Response**
115,200	164	523
57,600	123	273
19,200	66	94
9600	39	47

Sampling rates are in samples per second for a single analog channel or 8 bit digital I/O port tested on Windows 2000 850 Mhz P3 with A/D clock running at full speed. Samples per channel = Sample rate ÷ number of channels being sampled.

Modes of Operation:
The Integrity Instruments **485M300 Series** I/O modules operates in the Polled Mode.

Polled Mode
The Polled Mode is the most common usage of the **485M300 Series** I/O modules. In this mode the Host computer sends a command to the I/O Modules which in turn sends an associated response back to the Host computer.

Digital I/O Characteristics
The following chart lists the Digital I/O characteristics and values.

Characteristic	Value
Digital I/O Current	I/O line source & sink 25 ma Total current PORT1 200 ma Total current PORT2 200 ma
Digital I/O Voltage Levels	Input Off (0) = 0V - 0.8V Input On (1) = 2.0V - 5.0V Output Off (0) = 0.6V max. Output On (1) = 4.3V min.
Pulse Counter Input	1 Mhz max. input rate 32 bit counter capture **Counter increments on high-low transition**

Digital Port Configuration Example

Any Digital I/O configuration changes made to the I/O Module using the '**T**' command are stored in EEPROM locations 0x02 and 0x03.

EEPROM Location 0x02 Port 1 I/O Configuration
EEPROM Location 0x03 Port 2 I/O Configuration

When using either the '**T**' command or directly writing to EEPROM using the '**W**' command, a binary 1 at a bit location puts the I/O line into Input mode, while a binary 0 at a bit location puts the I/O line into Output mode.

NOTE

- All numeric data is represent as ASCII Hexadecimal integers
- The symbol ↵ equates to a carriage return (decimal 13, hex 0x0D)

Host Command	Module Response	Action
T0000↵	T↵	All I/O lines are configured as Outputs
TFFFF↵	T↵	All I/O lines are configured as Inputs
TFF00↵	T↵	Port 1 bits 0-7 Inputs Port 2 bits 0-7 Outputs
T00FF↵	T↵	Port 1 bits 0-7 Outputs Port 2 bits 0-7 inputs
T1234↵	T↵	Port 1 bits 4,1 Inputs Port 1 bits 7,6,5,3,2,0 Outputs Port 2 bits 4,5,2 Inputs Port 2 bits 7,6,3,1,0 Outputs

Pulse Width Modulation (PWM) Characteristics

The **485M300 Series** modules have a configurable PWM output. There are two settings to configure for proper PWM operation: **PWM frequency** and **PWM duty cycle**.

PWM — Command

Pxxyyy xx = Pwm_Divisor yyy = Pwm_Duty (10 bits max.)

Pwm_Divisor = 0x00 ... 0xFF
Pwm_Duty = 0x000 ... 0x3FF **Pwm_Duty = 0, PWM output is disabled (output 0)**

PWM — Control Values (14.7456 Mhz clock)

PWM Period = (Pwm_Divisor + 1) / 3686400
PWM Duty Period = (Pwm_Duty) / 14745600
Duty_Resolution = log (14745600/ Fpwm) / log (2)
PWM Duty Cycle % = PWM Duty Period / PWM Period

if (PWM Duty Period > PWM Period) then PWM Duty Cycle = 100%

Pwm_Divisor	PWM Freq	Duty_Resolution
0xFF (255)	14400 Hz	10 bits* (**see note**)
0xFE (254)	14456 Hz	10 bits
0x5B (91)	40069 Hz	8 bits
0x00 (0)	3686400 Hz	2 bits

*** Note:** Pwm_Divisor 0xFF cannot achieve complete 100% duty cycle. Use Pwm_Divisor 0xFE if 100% duty cycle is required.

Example PWM Commands

- All numeric data is represent as ASCII Hexadecimal integers
- The symbol ↵ equates to a carriage return (decimal 13, hex 0x0D)

Host Command	Module Response	Action
P0000↵	P↵	**PWM off** Any duty cycle of 0 disables PWM output
P4801F↵	P↵	PWM frequency = 50499 Hz PWM duty = 10.6%
PFE3FF↵	P↵	PWM frequency = 14456 Hz PWM duty = 100%
PFE1FE↵	P↵	PWM frequency = 14456 Hz PWM duty = 50%

Analog I/O Characteristics:

Characteristic	Value
A/D Converter	Linear Tech LTC1296BCN ± .5 LSB
Linearity Error	LTC1296BCN ± 0.012% (± .5 LSB)
Gain Error	± 0.012% (± .5 LSB)
Offset Error	± 0.17%
Temperature Drift	100 ppm/ºC (max.)
Max Input Voltage	5V
D/A Converter	Linear Tech LTC1448
Offset Error	± 10 mv

LTC1296 Operation
The analog inputs of the LTC1296 look like a 100pf capacitor (**C**in) in series with a 500 Ω resistor (**R**on). **C**in gets switched between (+) and (-) inputs once during each conversion cycle. Large external source resistors and capacitances will slow the settling of the inputs. It is important that the overall RC time constant is short enough to allow the analog inputs to settle completely within the allowed time.

The voltage on the inputs must settle completely within the sample period. Minimizing **R**source will improve the settling time. If large source resistance must be used, the sample time can be increased by using a slower CLK frequency.

Sampling Analog Voltage Inputs
By far the most common configuration of the **485M300 Series** I/O modules is to sample voltage values. Analog voltage levels are converted to integer digital values using the Linear Technologies LTC1296 A/D (Analog/Digital) chip. The input voltage range is determined by the reference voltage.

There are two analog sample types:

1) **Unipolar**
2) **Bipolar**

Both A/D sampling types result in a 12 bit binary integer value.

Vref = 5.000 standard

Unipolar Analog Sampling Resolution
Unipolar analog sampling span is from ground (GND) to voltage reference (Vref). **Only positive voltages are sampled in unipolar mode.** The unipolar sample is represented as an unsigned integer as follows:

Unipolar voltages: 0V ... +Vref

The benefit of using Unipolar samples over Bipolar samples is that a 12 bit binary value is spread out over less total voltage span (Vref total.)

1 LSB unipolar = Vref/4096
1 LSB unipolar = 5.000/4096
1 LSB unipolar = 0.0012207 volt

Bipolar Analog Sampling Resolution
Bipolar analog sampling span is from -Vref to +Vref. Both negative and positive voltages are sampled and represented as a signed binary integer (2's complement) as follows:

Bipolar voltages: -Vref ... 0 ... +Vref

The benefit of using Bipolar sampling over Unipolar is obvious, negative voltages! The downfall of using Bipolar sampling is that a 12 bit binary value is spread out over a larger total voltage span (2*Vref total.)

1 LSB bipolar = Vref/2048
1 LSB bipolar = 5.000/2048
1 LSB bipolar = 0.0024414 volt

Voltage Conversion
The Analog conversion value obtained from the **485M300 Series** module is represented as an integer value (either signed for Bipolar samples or unsigned for Unipolar sample) and is normally converted to a Real or Floating Point number for ultimate usage.

Vref = 5.000 standard

Unipolar Voltage Conversion Formula

Volts [unipolar] = ADC_Sample * (5.000/4096)
Volts [unipolar] = ADC_Sample * 0.0012207

Bipolar Voltage Conversion Formula
The following assumes that ADC_Sample is an unsigned integer value.

```
if (ADC_Sample >= 2048)
        Volts [bipolar] = (ADC_Sample-4096) * (5.000/2048)

if (ADC_Sample <= 2047)
        Volts [bipolar] = ADC_Sample * (5.000/2048)
```

```
if (ADC_Sample >= 2048)
        Volts [bipolar] = (ADC_Sample-4096) * 0.0024414

if (ADC_Sample <= 2047)
        Volts [bipolar] = ADC_Sample * 0.0024414
```

Sampling Current (4-20 ma) Inputs

Many devices output a current value instead of a voltage value. The secret to obtaining current readings is a 250 ohm resistor. Placing a 250 ohm resistor to ground on a 4-20 ma. current input will create a voltage potential of 1V to 5V.

If we remember Ohm's law: E = I * R

R = 250 ohms
I = .004 to .020 amps (4-20 ma.)
E = 1.0V to 5.0V

Obtaining current readings is a three step process:

1. Perform analog Unipolar sample
2. Convert unipolar sample to volts
3. Convert voltage to amps

The following formula will convert the raw analog sample reading to a current value.

Current = (ADC_Sample * (5.000/4096)) / 250

Obtaining accurate Analog samples

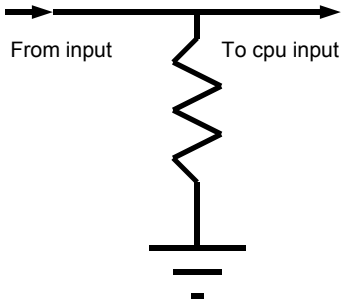
Please keep the following points in mind when attempting to obtain accurate samples.

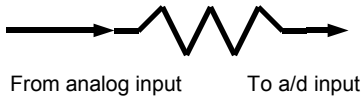
- Avoid high impedance analog signal sources!
- Watch out for UPS systems! They create loads of EMI/EMF noise.
- Keep the analog signal source as close to the ADC-x module as possible.
- Keep transformers far away from the **485M300 Series** module.
- Use good wiring practices, especially in regards to ground connections.
- RS-232 interface can generate approx. 2 mv noise.

Resistors for Analog and Digital I/O

The digital I/O points have a 100K Ω resistor to ground to prevent floating inputs.

The analog inputs have a 560 Ω resistor in series to afford some protection to the A to D converter.





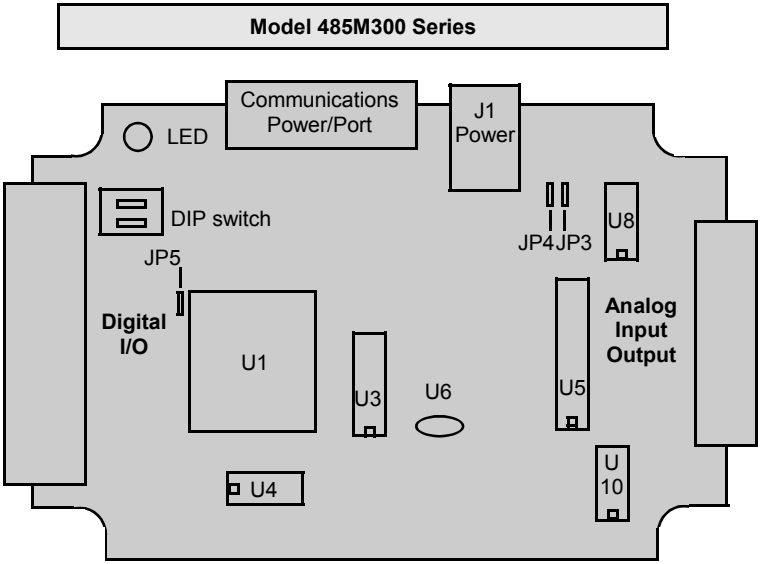
Digital & Analog I/O Port Pin outs And Hex Conversion Chart

	EXAMPLE HEX CONVERSION															
	X				X				Y				Y			
BITS	1	1	0	0	1	0	0	0	1	0	1	1	0	1	1	1
HEX	C				8				B				7			

Analog I/O	
DB15 Pins	Description
1	ANALOG IN CHANNEL 7
2	ANALOG IN CHANNEL 6
3	ANALOG IN CHANNEL 5
4	ANALOG IN CHANNEL 4
5	ANALOG IN CHANNEL 3
6	ANALOG IN CHANNEL 2
7	ANALOG IN CHANNEL 1
8	ANALOG IN CHANNEL 0
9	GND
10	+ V UNREG
11	+ 5VDC REG
12	- V UNREG
13	V REFERENCE
14	ANALOG OUT B
15	ANALOG OUT A

Digital I/O	
DB25 Pins	Description
1	Port 2 Bit 0
2	Port 2 Bit 1
3	Port 2 Bit 2
4	Port 2 Bit 3
5	Port 2 Bit 4
6	Port 2 Bit 5
7	Port 2 Bit 6
8	Port 2 Bit 7
9	PWM output
10	N/A
11	+V Unreg
12	+5Vdc
13	GND
14	Port 1 Bit 0
15	Port 1 Bit 1
16	Port 1 Bit 2
17	Port 1 Bit 3
18	Port 1 Bit 4
19	Port 1 Bit 5
20	Port 1 Bit 6
21	Port 1 Bit 7
22	Pulse Counter Input
23	-V Unreg
24	+5Vdc
25	GND

PORT 1									PORT 2							
X					X				Y					Y			
HEX VALUE	BIT VALUE				HEX VALUE	BIT VALUE			HEX VALUE	BIT VALUE				HEX VALUE	BIT VALUE		
	7	6	5	4		3	2	1	0		7	6	5	4		3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	1
2	0	0	1	0	2	0	0	1	0	2	0	0	1	0	2	0	0	1	0
3	0	0	1	1	3	0	0	1	1	3	0	0	1	1	3	0	0	1	1
4	0	1	0	0	4	0	1	0	0	4	0	1	0	0	4	0	1	0	0
5	0	1	0	1	5	0	1	0	1	5	0	1	0	1	5	0	1	0	1
6	0	1	1	0	6	0	1	1	0	6	0	1	1	0	6	0	1	1	0
7	0	1	1	1	7	0	1	1	1	7	0	1	1	1	7	0	1	1	1
8	1	0	0	0	8	1	0	0	0	8	1	0	0	0	8	1	0	0	0
9	1	0	0	1	9	1	0	0	1	9	1	0	0	1	9	1	0	0	1
A	1	0	1	0	A	1	0	1	0	A	1	0	1	0	A	1	0	1	0
B	1	0	1	1	B	1	0	1	1	B	1	0	1	1	B	1	0	1	1
C	1	1	0	0	C	1	1	0	0	C	1	1	0	0	C	1	1	0	0
D	1	1	0	1	D	1	1	0	1	D	1	1	0	1	D	1	1	0	1
E	1	1	1	0	E	1	1	1	0	E	1	1	1	0	E	1	1	1	0
F	1	1	1	1	F	1	1	1	1	F	1	1	1	1	F	1	1	1	1



485M300 Series IC descriptions

IC	Model **485M3AD** (Position and type is the same for all models)
U1	PIC16C65B MPU
U3	LTC1487 RS-485 driver [8 pin DIP]
U4	25C040 EEPROM [8 pin DIP]
U5	LTC1296 A to D [20 pin DIP]
U6	LM4040AIZ-5.0 0.1% Voltage Reference
U8	LMC555 Timer charge pump [8 pin DIP]
U10	LTC1448 D to A [8 pin DIP]

Baud Rate Switch and Jumper Settings			
SW1	**SW2**	**Baud Rate**	**Jumper Settings (factory default)**
OFF	OFF	9600 baud	JP3/JP4 On 485 termination
ON	OFF	19200 baud	
OFF	ON	57600 baud	JP5 On Approx 2ms Delayed Response
ON	ON	115200 baud **(factory default)**	

485M Series Module Specifications

LED Operation

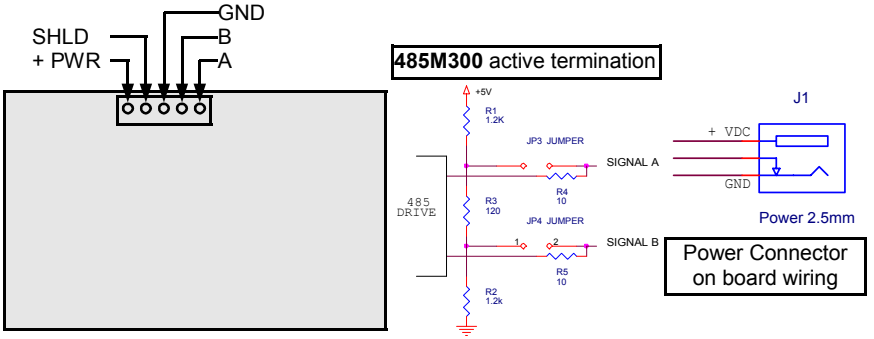
Blinking Green	[1 per Second]	Unit functioning correctly - idle
Blinking Green	[Rapid or Steady]	Unit receiving serial data
Blinking Red	[Rapid or Steady]	Unit transmitting serial data
No LED		Unit is not functioning

Power Supply

7.5-15.0Vdc approx. 50 ma. (we suggest our PS9J 9VDC 400 ma unregulated])

GND and Shield

The GND and Shield terminals are connected on the **485M300** Series boards and are therefore electrically equivalent.



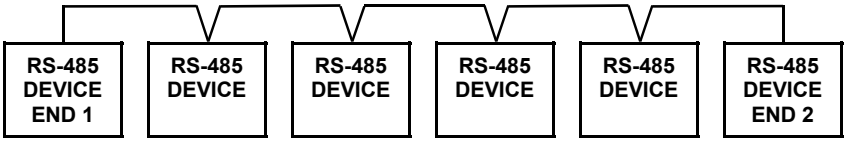
RS-485 Cabling

The **485M300 Series** is designed to operate in a Multi-Drop RS-485 LAN configuration. In a half-duplex mullti-drop environment all RS-485 nodes share the same data lines. A single pair of data lines act as both Transmit and Receive wires.

*** Data lines (A/B) are the only wires required between RS-485 nodes**
*** All RS-485 nodes need not share the same V+ and GND**

Cabling Notes:

1) Gnd and Shld are connected internally within the **485M300 Series** modules
2) Cable termination is important for long distanceand high-speed applications
3) Suggested cable: 24 awg stranded twisted pair with shield for cable runs in excess of 200 feet. See also Belden cable #9841 and #9463.
4) The normal connection method is the “Daisy Chain” type shown below. there are other kinds of connections, but this is considered as the standard.
5) The end units (END 1) and (END 2) should be terminated. All other units should not.



DAISY CHAIN

Peripheral Add-On Modules

AE-8CH	8 channel analog connection board
ASC-2CH	2 channel signal conditioner
DB15TSM	DB15 terminal strip (for analog connector)
DB25TSM	DB25 terminal strip (for digital connector)
EXP-x	Digital Interface board

Model: AE-8CH Analog Connection Board

Jumper configurable analog inputs:

1) 4-20 ma inputs
2) +/- 10 Vdc inputs
3) Solid state temperature probes

Handy terminal strip for all analog connections and voltages. MTA .100 jacks are also available for solid state temperature probes available from Integrity Instruments.

Model: ASC-2CH Signal Conditioning Board

2 channels of precision instrumentation amplifiers.
Gains of 1, 10, 100, 1000

Handy terminal strip for all analog connections and voltages.

Models: DB15TSM and DB25TSM DB Terminal Strip

Terminal strip boards to conveniently connect to DB15 and DB25 connectors.

Models: EXP-x Digital Interface Board

The **EXP-X** unit provides for digital interface and signal conditioning via industry standard opto-isolated I/O modules such as Opto-22. Each unit has 4 I/O points with large easy to use terminal screws. If more I/O points are required, simply plug in another unit up to 16 total I/O points. **Opto isolated modules:** 90V-140V AC input, 12V-140V AC output, 3.3V-32V DC input, 3V-60V DC output.

WARRANTY
Integrity Instruments warranties **all** products against defective workmanship and components for the life of the unit. Integrity Instruments agrees to repair or replace, at it's sole discretion, a defective product if returned to Integrity Instruments with proof of purchase. Products that have been mis-used, improperly applied, or subject to adverse operating conditions fall beyond the realm of defective workmanship and are not convered by this warranty.

Revision: January 3, 2005 - v3.0