Communications Specifications for the TDD display

Contents

1 Communications

A simple communication protocol allows the unit to communicate with a host computer via the 9600-bps serial link using RS232 or multi-drop RS485 signal levels. Data is formatted with 1 start bit, 8 data bits and no parity and 1 Stop bit at 9600 baud.

Communications are always half duplex meaning that only one device, master or slave, transmits at a time. The master always sends a command and then the slave responds. The master must wait for the response before transmitting the next command. All messages to the display must start with '$' and the node ID of the TDD. All good responses from the display start with '*'. All messages are terminated with a single carriage return – ASCII 13 (indicated by '↵' in the text). All commands are case sensitive.

The node ID of the display defaults to 1. This can be changed via the serial link or the front panel. All displays will respond to a node ID of 0 regardless of their own Node ID setting. When the TDD is used in a multi-drop serial configuration each TDD must have a unique Node ID from 1 to 9. The TDD provides a 20 millisecond turn around delay before responding to commands, allowing the host device to stop driving the line before the TDD attempts to drive the line in response.

1.1 Control Messages

These messages are used to control how read and set messages are processed.

WE	Write Enable
Sets the write enable flag, allowing write protected messages to be used. Write enable is active until the unit's power is reset or the write protect command is issued.	
Example: $1WE↵	
Response	**Meaning**
*↵	Command successful.

WP	Write Protect
Clears the write enable flag, making write protected messages inactive. Write protect is the default condition and is active until the write enable command is issued.	
Example: $1WP↵	
Response	**Meaning**
*↵	Command successful.

1.2 Read Messages

These messages retrieve data from the display.

1.2.1 All Models

The following messages are applicable to all TDD models.

Rd	Read Direction Sense
Returns the direction sense.	
Example: $1Rd↵	
Response	**Meaning**
*POS↵	Direction sense is positive.
*NEG↵	Direction sense is negative.

RD	Read Position
Returns the position in units. The output position is scaled and offset.	
Example: $1RD↵	
Response	**Meaning**
*12.345↵	The magnet position is 12.345 units.

RE	Read Enable Flag
Returns the state of the Enable Flag. (Options C and D apply only to TDD MM15 models) (more information on the enable flag is available in section **Error! Reference source not found.**)	
Example: $1RE↵	
Response	**Meaning**
*A↵	The front panel will be enabled/disabled.
*B↵	The display will be enabled/disabled.
*C↵	The reference magnet will be changed.
*D↵	The reference magnet will be changed and the front panel will be disabled unless the enable input is active during startup.

Ri	Read Node ID
Returns the node id of the display. Using a node ID of 0 in the request message allows retrieval of an unknown node ID.	
Example: $0Ri↵	
Response	**Meaning**
*1↵	The node ID is set to 1.

RO	Read Offset
Returns the current offset in units.	
Example: $1RO↵	
Response	**Meaning**
*12.345↵	The current offset is 12.345 units.

RP	Read Decimal Places
Returns the number of digits shown the right of the decimal point during normal operation.	
Example: $1RP↵	
Response	**Meaning**
*3↵	Three decimal places will be shown.

RS	Read Scale
Returns the scale value.	
Example: $1RS↵	
Response	**Meaning**
*1.0000↵	The scale is 1.0000.

Ru	Read Units
Returns the current units.	
Example: $1Ru↵	
Response	**Meaning**
*IN↵	The display works with inches.
*MM↵	The display works with millimeters.
*CM↵	The display works with centimeters.

RV	Read Version
Returns the software compile date and model information.	
Example: $1RV↵	
Response	**Meaning**
*06/08/98 TDD-R-LA↵	The software was compiled on May 8, 1998 and included support for Start/Stop transducers, analog output, and limit switches.

Rz	Read Remote Zero Flag
Returns the state of the remote zero flag.	
Example: $1Rz↵	
Response	**Meaning**
*NONE↵	The remote zero is disabled.
*OFFSET↵	The remote zero affects the offset.
*USER↵	The remote zero affects the user zero.

RZ	Read Zero Operation
Returns the zero operation; the value found in section **Error! Reference source not found.** indicating the effect of pressing the ‘enter’ button during normal operation.	
Example: $1RZ↵	
Response	**Meaning**
*0↵	The remote zero is enabled.
*2↵	The display will save the offset when the ‘enter’ button is held for 2 seconds.

1.2.2 TDD-R Models

The following messages are applicable to TDD-R models only.

RG	Read Gradient
Returns the gradient of the transducer in microseconds per inch.	
Example: $1RG↵	
Response	**Meaning**
*9.0120↵	The transducer has a gradient of 9.0120 microseconds per inch.

1.2.3 TDD-S Models

The following messages are applicable to TDD-S models only.

Re	Read Error Bit 21 Flag
Returns the state of the error bit 21 flag.	
Example: $1Re↵	
Response	**Meaning**
*OFF↵	Bit 21 will not be treated specially.
*ON↵	Bit 21 will be used as an error bit.

RR	Read Resolution
Returns the resolution of the transducer in units.	
Example: $1RR↵	
Response	**Meaning**
*0.0005↵	The transducer returns 0.0005 units per count.

RT	Read Transducer Type
Returns the SSI transducer type. The response is formatted as follows: *xx*B. *xx* is the number of bits returned from the transducer.	
Example: $1RT↵	
Response	**Meaning**
*24B↵	The transducer is expected to return 24 bits of data.

1.2.4 TDD LA Models

The following messages are applicable to TDD LA models only.

RA	Read Analog Type
Returns the analog type. The analog type can be either position, velocity, or forced.	
Example: $1RA↵	
Response	**Meaning**
*POS↵	Analog type is position.
*VEL↵	Analog type is velocity.
*FORCED↵	Analog type is forced.

RI	Read Limit Edit Increment
Returns the amount the limit bound will be changed when edited from the front panel.	
Example: $1RI↵	
Response	**Meaning**
*1.0000↵	The limit bound will be incremented or decremented by 1.0000 units.

RL*xy*	Read Limit
Returns the value of a limit switch or its bounds. ***x*** is the limit switch number, 1-5. ***y*** is either 'L', 'U', or 'V'. 'L' refers to the lower bound of the limit switch; 'U' to the upper bound. If *y* is 'V', whether the limit switch is on or off is returned.	
Example: $1RL1L↵	
Response	**Meaning**
*12.345↵	The bound of the limit is 12.345 units
*ON↵	The limit is currently on.
*OFF↵	The limit is currently off.

RN	Read Limit Edit Number
Returns the number of the limit bound to be edited from the front panel.	
Example: $1RG↵	
Response	**Meaning**
*4↵	Limit 2 upper bound will be edited.

Rr	Read Analog Range
Returns the analog range. If the analog type is position, this is the number of units the analog output covers. If the analog type is velocity, this is the number of units per second the output includes on either side of 0. If output is forced, this is the percentage of maximum the output is forced to.	
Example: $1Rr↵	
Response	**Meaning**
*10.000↵	The analog range is 10.000 units

Rs	Read Analog Start
Returns the start of the analog range in units. This value is used for position analog output only. Velocity output centers on 0.	
Example: $1Rs↵	
Response	**Meaning**
*5.000↵	The analog range starts at 5.000 units.

RU	Read Analog Update
Returns the analog update period in milliseconds.	
Example: $1RU↵	
Response	**Meaning**
*20.000↵	The analog update period is 20 ms.

Rv	Read Limit Invert Flag
Returns the state of the limit invert flag, either ON or OFF.	
Example: $1RI↵	
Response	**Meaning**
*OFF↵	The limit invert flag is off.

1.2.5 TDD MM15 Models

The following messages are applicable to TDD MM15 models only.

RF	Read Display Mode
Returns the current display mode.	
Example: $1RF↵	
Response	**Meaning**
*ABS↵	The display mode is absolute.
*REL↵	The display mode is relative.
*GAP↵	The display mode is gap.

Rg	Read Gap Number
Returns the configured gap number.	
Example: $1Rg↵	
Response	**Meaning**
*1↵	The displayed gap is gap 1 (magnets 1 and 2).
*7↵	The displayed gap is gap 7 (magnets 7 and 8).

RK	Read Kerf
Returns the current kerf setting.	
Example: $1RK↵	
Response	**Meaning**
*0.0↵	The kerf is set to 0.0 units.
*0.125↵	The kerf is set to 0.125 units.

RM	Read Number of Magnets
Returns the number of magnets configured to be on the transducer.	
Example: $1RM↵	
Response	**Meaning**
*1↵	Configured for 1 magnet.
*2↵	Configured for 2 magnets.
*13↵	Configured for 13 magnets.

Rm	Read Displayed Magnet
Returns the displayed magnet.	
Example: $1Rm↵	
Response	**Meaning**
*2↵	The displayed magnet is magnet 2.
*5↵	The displayed magnet is magnet 5.

Rn	Read Reference Magnet
Returns the configured reference magnet.	
Example: $1Rn↵	
Response	**Meaning**
*1 ↵	The reference magnet is magnet 1.
*7↵	The reference magnet is magnet 7.

1.2.6 TDD-RR and TDD-NR Models

The following messages are applicable to TDD-RR and TDD-NR models only.

Rm	Read Recirculations
Returns the current number of recirculations.	
Example: $1Rm↵	
Response	**Meaning**
*1↵	1 recirculation is being performed.
*4↵	4 recirculations are being perfomed.

1.2.7 TDD LIN Models

The following messages are applicable to TDD LIN models only.

RBn	Read Breakpoint
With no argument, returns the number of breakpoints. Otherwise, returns the raw position and corrected position of breakpoint *n*.	
Example: $1RB12↵	
Response	**Meaning**
*12.964,13.0↵	The position 12.964 is being corrected to 13.0.
*3↵	3 breakpoints are currently stored.

RBn	Read Breakpoint
With no argument, returns the number of breakpoints. Otherwise, returns the raw position and corrected position of breakpoint *n*.	
Example: $1RB12↵	
Response	**Meaning**
*12.964,13.0↵	The position 12.964 is being corrected to 13.0.
*3↵	3 breakpoints are currently stored.

1.3 Set Messages

The following messages are used to setup values on the display. Due to the danger of accidental data change, all set commands are write protected. The write enable flag must be set before a write will occur. If a set message is used while the write enable flag is not set, the write protected error will be returned. Values set using the RS-232 serial link are stored in nonvolatile EEPROM memory immediately.

1.3.1 All Models

The following messages are applicable to all TDD models.

Sd*x*	Set Direction Sense
Sets the transducer direction sense. ***x*** must be either 'POS' or 'NEG'. (See message Rd above).	
Example: $1SdPOS↵	
Response	**Meaning**
*↵	The command was successful.

SE*x*	Set Enable Flag
Sets the enable flag. ***x*** must be either 'A' or 'B'. (See message RE above). ('C' and 'D' are also legal with TDD MM15 models)	
Example: $1SEB↵	
Response	**Meaning**
*↵	The command was successful.

Si*x*	Set Node ID
Sets the node ID. Using a node ID of zero in the request message can allow setting the node ID of a TDD regardless of the previous node ID setting.	
Example: $1Si2↵	
Response	**Meaning**
*↵	The command was successful.

SO*xx.xxx*	Set Offset
Sets the offset. ***xx.xxx*** is the new offset in units.	
Example: $1SO5.000↵	
Response	**Meaning**
*↵	The command was successful.

SP*x*	Set Decimal Places
Sets the number of decimal places to be displayed. ***x*** is the the number to display (0-5).	
Example: $1SP2↵	
Response	**Meaning**
*↵	The command was successful.

SS*xx.xxx*	Set Scale
Sets the scale.	
Example: $1SS0.08333↵	
Response	**Meaning**
*↵	The command was successful.

Su*x*	Set Units
Sets the current units. ***x*** must be IN (inches), MM (millimeters), or CM (centimeters).	
Example: $1SuIN↵	
Response	**Meaning**
*↵	The command was successful.

Sz*x*	Set Remote Zero Enable Flag
Sets the state of the remote zero enable flag. ***x*** must be NONE (disabled), USER (user zero), or OFFSET.	
Example: $1SzUSER↵	
Response	**Meaning**
*↵	The command was successful.

SZ*x*	Set Zero Operation
Sets the zero operation. *x* must be a number (refer to the table in section **Error! Reference source not found.**) indicating the effect of pressing the 'enter' button during normal operation.	
Example: $1SZ0↵	
Response	**Meaning**
*↵	The command was successful.

1.3.2 TDD-R Models

The following messages are applicable to TDD-R models only.

SG*xx.xxx*	Set Gradient
Sets the transducer gradient. ***xx.xxx*** is the number of microseconds per inch the transducer is calibrated to.	
Example: $1SG9.0102↵	
Response	**Meaning**
*↵	The command was successful.

1.3.3 TDD-S Models

The following messages are applicable to TDD-S models only.

Se*x*	Set Error Bit 21 Flag
Sets the error bit 21 flag. ***x*** must be either 'OFF' or 'ON'.	
Example: $1SeON↵	
Response	**Meaning**
*↵	The command was successful.

SR*xx.xxx*	Set Resolution
Sets the resolution of the transducer. ***xx.xxx*** is the number of units per bit that is returned by the transducer.	
Example: $1SR0.0005↵	
Response	**Meaning**
*↵	The command was successful.

St*xy*	Set Transducer Type
Sets the SSI transducer type. ***xx*** must be either 24 or 25, corresponding to the number of bits the transducer returns. ***y*** must be 'B', corresponding to binary coded position return.	
Example: $1ST24B↵	
Response	**Meaning**
*↵	The command was successful.

1.3.4 TDD LA Models

The following messages are applicable to TDD LA models only.

SA*x*	Set Analog Type
Sets the analog type. ***x*** must be either 'POS', 'VEL', or 'FORCED' (See message RA above).	
Example: $1SAPOS↵	
Response	**Meaning**
*↵	The command was successful.

SI*xx.xxx*	Set Limit Edit Increment
Sets the amount the limit bound will be incremented or decremented by when edited from the front panel in units.	
Example: $1SI1.500↵	
Response	**Meaning**
*↵	The command was successful.

SL*xyzz.zzz*	Set Limit
Sets a limit bound. ***x*** is the number of the limit to affect (1-5), and ***y*** is either 'L' if the lower bound will be affected, or 'U' if the upper bound will be affected. ***zz.zzz*** is the new value of the limit bound.	
Example: $1SL1L5.000↵	
Response	**Meaning**
*↵	The command was successful.

SN*xx*	Set Limit Edit Number
Sets the number of the limit that will be edited through the front panel. Setting this to zero will prevent a limit from being edited.	
Example: $1SN4↵	
Response	**Meaning**
*↵	The command was successful.

Sr*xx.xxx*	Set Analog Range
Sets the analog range. If the analog type is position, this is the number of units the analog output covers. If the analog type is velocity, this is the number of units per second the output represents on either side of 0. If the analog type is forced, this is the percentage of maximum the analog output will be set to.	
Example: $1Sr5.000↵	
Response	**Meaning**
*↵	The command was successful.

SU*xx*	Set Analog Update
Sets the analog update period. xx must be the desired update period in milliseconds.	
Example: $1SU50↵	
Response	**Meaning**
*↵	The command was successful.

Sv*xxx*	Set Limit Invert Flag
Sets the limit invert flag. xxx must be either ON or OFF.	
Example: $1SION↵	
Response	**Meaning**
*↵	The command was successful.

Ss*xx.xxx*	Set Analog Start
Sets the start of the analog range. This value is used for position output only.	
Example: $1Ss5.000↵	
Response	**Meaning**
*↵	The command was successful.

1.3.5 TDD MM15 Models

The following messages are applicable to TDD MM15 models only.

SFxxx	Set Display Mode
Sets the display mode to *xxx*, where *xxx* can be ABS, REL, or GAP. ABS corresponds to absolute mode, REL to relative mode, and GAP to gap mode.	
Example: $1SAREL↵	
Response	**Meaning**
*↵	The command was successful.

Sg*x*	Set Reference Magnet
Sets the displayed gap to *x*.	
Example: $1Sg3↵	
Response	**Meaning**
*↵	The command was successful.

SK*xx.xxx*	Set Kerf
Sets the kerf to *xx.xxx*, where *xx.xxx* is a position in units.	
Example: $1SK0.250↵	
Response	**Meaning**
*↵	The command was successful.

SM*x*	Set Number of Magnets
Configures the expected number of magnets to *x*.	
Example: $1SM8↵	
Response	**Meaning**
*↵	The command was successful.

Smx	Set Displayed Magnet
Sets the displayed magnet to *x*.	
Example: $1Sn4↵	
Response	**Meaning**
*↵	The command was successful.

Snx	Set Reference Magnet
Sets the reference magnet to *x*.	
Example: $1Sn12↵	
Response	**Meaning**
*↵	The command was successful.

1.3.6 TDD-RR and TDD-NR Models

The following messages are applicable to TDD-RR and TDD-NR models only.

Smx	Set Recirculations
Sets the number of recirculations to *x*. *x* can range from 1 to 16.	
Example: $1Sm4↵	
Response	**Meaning**
*↵	The command was successful.

1.3.7 TDD LIN Models

The following messages are applicable to TDD LIN models only.

SB*x.xx,y.yy*	Set Breakpoint
Adds a breakpoint to the inactive breakpoint table. Position *x.xx* will be corrected to *y.yy*. Points must be added in increasing order. Linearity must be disabled before adding points.	
Example: $1SB4.529,4.50↵	
Response	**Meaning**
*↵	The command was successful.

Sb	Save Linearity Table
Saves the inactive linearity table to EEPROM and makes the active table equal to the inactive table.	
Example: $1Sb↵	
Response	**Meaning**
*↵	The command was successful.

Sl	Enable Linearity
Enables linearization of position data using the current active table.	
Example: $1Sn12↵	
Response	**Meaning**
*↵	The command was successful.

St	Disable Linearity
Disables linearization of position data.	
Example: $1Sn12↵	
Response	**Meaning**
*↵	The command was successful.

2 TDD WinComm

TDD WinComm is a utility program that runs under all 32 bit Windows operating systems (95, 98 NT, 2000, XP, ME). The program allows the user to read and set values inside the TDD as well as read position displays. TDD WinComm is a free utility that can downloaded from the Rapid Controls web site.

3 TDD WinComm Installation FAQ

Q1. How do I install on a system which displays the error message "*Error occurred while registering file…*" during setup?

A1. Microsoft provides a file named VBRUN60SP5.EXE which upgrades the DLLs present on your system to the versions required for Visual Basic 6.0 applications. Attempt installation after running this program on your computer. VBRUN60SP5.EXE is available via the web at: *http://download.microsoft.com/download/vb60pro/Redist/sp5/WIN98Me/EN-US/VBRun60sp5.exe*

4 Connections

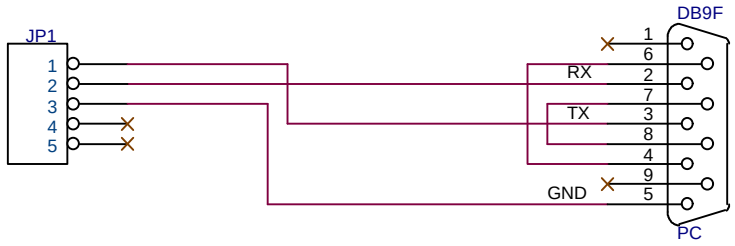
4.1 Communications Connector

Phoenix type

1. RS232 Receive
2. RS232 Transmit
3. Ground
4. RS485 +
5. RS485 –

4.2 RS485 Termination Jumpers

Jumpers X6 and X7 can be installed to provide a 120 ohm termination of the RS485 interface. They are installed when the unit is shipped from the factory and must be installed for the RS232 interface to work correctly. If more than 1 TDD is connected using RS485 then the jumpers should be removed from all but the last TDD.



TDD TO PC RS232

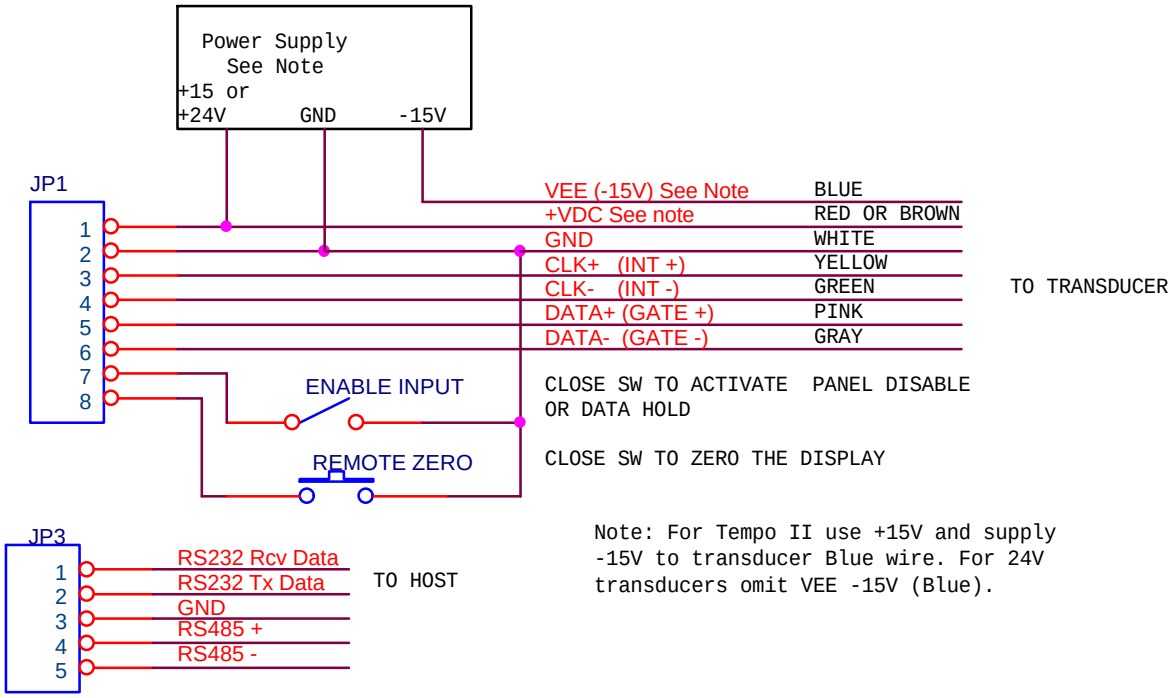


Figure 1 TDD Connections