COMPUTER TO TCS
ASCII COMMUNICATIONS

Command Descriptions

Minor revision May 17, 1996
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This revision addresses changes to beamswitch, OFFSET, and TCSINFO descriptions and new Tip-Tilt related entries POLL-OFB, -OFST, and +OFST.

This document is on the Web (in individual sections) at http://irtf/irtf/tcs/tcshome.html, and is online in PostScript form at the IRTF on herschel at ~harwood/document/comlnk.ps, and at Manoa HQ on jeans at /pc.shared/document/comlnk.ps.

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1. PART I

1.1 Introduction

Following is a description of the Forth commands issued from a remote computer to cause the TCS to perform certain functions. In all cases, the commands must be in upper case and have arguments delimited by spaces before the command (standard Forth protocol).

These commands may be typed in for testing at either the LSI-11 or at the remote computer in terminal emulation mode. The TCS response to the commands will be exactly the same, whether the commands are issued from a terminal or from a program.

The end-of-stream prompt from the LSI-11 is **–OK***<cr><nl>*. This sequence (without the period) occurs at the end of the transmission from the LSI-11 and will always occur, whether or not other data is transmitted. If an LSI-11 transmission consists of multiple lines, the lines are ended with *<cr><nl>*.

In this document, ASCII strings returned to the remote computer from the LSI-11 are printed in **`typewriter style`**. Actual text is in upper case; lower case italics indicates a general format of the returned data, such as *hh:mm:ss*.

Ascii strings sent to the LSI-11 are printed here in **BOLDFACE**.

1.1.1.1 LSI-11 Response Formats:

You may need to know the exact format of the responses returned by the TCS LSI-11. In the examples in this document, the fields of the LSI-11 response are separated by more than one space for clarity. They actually are always separated by only one space. The fields are fixed format with respect to the number of characters in each field and the number of decimal places. For further information, see the author.

IMPORTANT NOTE: Some of these commands have a "wait for motion complete" option. The LSI-11 computer will hold off returning to the remote computer until completion of the instructions to move the telescope. However, *the telescope may still be physically moving*, since there is an inertial lag in the telescope response. The TCS does not check for this inertial lag. If this is important, you are advised to hold off the next operation for a second or two after the reply comes back from the LSI-11.

Also, use of the "wait for motion complete" may cause the communications link between the remote computer and the TCS to time out, creating a "comproc" (or other) error. The communications link at the remote computer expects the TCS to respond within a second or two to the transmitted command. Use the "wait for motion complete" option with care. In fact, you are advised NOT to wait for motion complete. Either provide a fixed time interval to allow the motion to complete, or loop on a request for status after sending the telescope motion command.

2. PART II

2.1 Command Summary

2.1.1 Telescope position, epoch commands:

n **TPD**

Requests current telescope position data from the monitor display variables.

n **LSP**

Requests the last-entered slew position and epoch.

yyyyy.y **C.EPOCH**

Requests a change of epoch.

2.1.2 Beamswitch commands:

ABEAM BBEAM

Positions the telescope at one of the beam positions. These two commands generate a notification over the serial port to the external workstation that a beamswitch is happening, so tip-tilt operations can anticipate the beamswitch. The notification also occurs if a beamswitch button is pressed at the console. It consists of the requested beam letter (A or B) and the "-OK" prompt.

?BEAM

Returns the current beam state.

>BEAM<

Reverses the assignment of beam A/B names without moving the telescope.

?BS

Returns the current beamswitch displacement.

ra.s dec.s **TW.BS**

Enters the displacements into the beamswitch thumbwheel locations.

?TW.BS

Returns the thumbwheel beamswitch displacement parameters.

2.1.3 *Offset commands:*

n **DO.OFFST** ***n*** **–DO.OFFST**

Causes the telescope to offset to the previously entered displacement (DO.OFFST) or back to the base position (–DO.OFFST). The "entered" displacement is in the thumbwheels.

?OFFST

Returns the current displacement from the offset base position.

ra.s dec.s **TW.OFFST**

Enters the displacements into the offset thumbwheel locations.

?TW.OFFST

Returns the previously entered offset displacements.

ra.s dec.s **OFFSET**

Causes offset to occur to the entered displacement position. Repeat the command with arguments of 0.0 to return to base. Do not use this command at the same time that scanning is done.

2.1.4 *Scan commands:*

r sss.s sss.s c **C.SCN**

General scan command. Allows for initializing the scan position, executing a given scan displacement, or going back to the scan base position.

?SCAN

Returns the current scan displacement from the base position.

2.1.5 Peak commands:

r sss.s sss.s c **C.PEAK**

General peak motion command. Allows for initializing the peak position, executing a given peak displacement, or going back to the peak base position.

?PEAK

Returns the current peak displacement from the base position.

2.1.6 Autoguider commands:

r sss.s sss.s c **C.AUTOG**

General autoguider motion command. Allows for initializing the autoguider position, executing a given autoguider displacement, or going back to the autoguider base position.

?AUTOG

Returns the current autoguider displacement from the base position.

v.s **!V.AUTOG**

Stores the given autoguider velocity.

?V.AUTOG

Returns the current autoguider velocity data.

2.1.7 Tip-Tilt related commands:

-OFST, +OFST

Used only by the Tip-Tilt software. Stops or enables communications from an external data acquisition program to go to the TCS.

POLL-OFB

Returns 1 if there is no offset from base motion, 0 if OFB motion is occuring. Used by the Tip-Tilt software.

2.1.8 Other commands:

hh:mm:ss.ss dd:mm:ss.s rpm.tttt dpm.sss yyyy.y **C.SLEW**

Sends the TCS the coordinates for a slew.

C.HST

Returns HST in 50^{th} seconds formatted as *ttttttt*.

C.STIME

Returns sidereal time from the TCS.

?DISP

Returns the total displacement from the telescope base position, taking into account all sources of offset-type displacements.

PB8

Resets the current telescope position as the base position for all functions except SCAN.

TCSINFO

Returns the telescope position, sidereal time, and HST.

3. PART III

3.1 Detailed Descriptions:

3.1.1 Telescope position, epoch commands

3.1.1.1 *n* TPD

Argument:

n=0 for requesting immediate reply.

n=1 for requesting wait for any offset-type motion to complete.

Request current telescope position data. The data returned for RA, dec, HA, airmass, and epoch are from the same variables that are read out on the monitor display.

Returns:

Current telescope coordinates as follows-

RA	DEC	HA	AIRMASS	EPOCH	
hh:mm:ss.ss	*dd:mm:ss.s*	*hh:mm:ss.ss*	*a.aaa*	*yyyy.y*	**-OK**

Example: 1 TPD

Returns from the TCS, after any offsetting has finished,

```
14:26:11.84 32:56:38.6 -01:44:29.21 1.187 1950 -OK
```

3.1.1.2 *n* LSP

Argument:

n=0 for requesting immediate reply.

n=1 for requesting wait for current slew to complete.

Request last-entered slew position and epoch. In case the last-entered slew was aborted, the data returned are 0 0 0.

Returns:

Last entered slew coordinates and epoch as follows-

RA	DEC	EPOCH	
hh:mm:ss.ss	*dd:mm:ss.s*	*yyyy.y*	**-OK**

Example: 1 LSP

Returns from the TCS, after the current slew is finished, its coordinates and epoch as-

```
9:23:41.84  41:19:55.6  1950.0  -OK
```

3.1.1.3 *yyyy.y* C.EPOCH

Argument:

Year in tenths. (0.0 for APPARENT.)

Requests a change of epoch, or if the argument is 0.0, a change from MEAN to APPARENT. If the original state was APPARENT, and a non-zero epoch is requested, the state will change to MEAN.

The TCS sends back as confirmation the new epoch preceded by the telescope coordinates corresponding to the shift in epoch.

Returns:

Telescope coordinates corresponding to the new epoch-

RA	DEC	HA	AIRMASS	EPOCH	
hh:mm:ss.ss	*dd:mm:ss.s*	*hh:mm:ss.ss*	*a.aaa*	*y.yy*	**-OK**

Example: 1950.0 C.EPOCH

Returns from the TCS-

```
14:26:11.84  32:56:38.6  -01:44:29.21  1.187  1950.0  -OK
```

3.1.2 Beamswitch commands

3.1.2.1 ABEAM BBEAM

Calls for positioning the telescope to the A-beam or B-beam logical position. (See **>BEAM<** for altering the logical to physical beam relationship.)

No data are returned from the TCS, except the usual **-OK**.

Positions the telescope at one of the beam positions. These two commands generate a notification over the serial port to the external workstation that a beamswitch is happening, so tip-tilt operations can anticipate the beamswitch. The notification also occurs if a beamswitch button is pressed at the console. It consists of the requested beam letter (A or B) and the “-OK” prompt.

3.1.2.2 ?BEAM

Returns the current beam state.

Example: **?BEAM**

Returns from the TCS-

ABEAM –OK or **BBEAM –OK**

3.1.2.3 >BEAM<

Toggles the current beam designation without moving the telescope, and reports back the logical beam state. Thus, the first time**>BEAM<** is used, logical beam A becomes physical beam B and vice-versa. The second time **>BEAM<** is used, the logical and physical beams are the same.

The logical beam is the designation within the program, and the physical beam is the actual telescope's beam position.

Example: **>BEAM<**

Sends back from the TCS, if the current beam is B, without moving the telescope-

ABEAM –OK

3.1.2.4 ?BS

Returns the current beamswitch position as a displacement from the beamswitch base position. The units are tenths arcseconds, positive for North and East. The RA coordinate difference has been multiplied by cos(dec) to produce the returned on-sky RA beamswitch displacement.

Returns:

Current telescope beamswitch displacement (after any pending beamswitch motion) as follows-

RA	DEC	
sss.s	*sss.s*	**–OK**

Example: **?BS**

Returns from the TCS-

0.0 –10.5 –OK

The return says that the telescope is currently zero arcseconds RA and 10.5 arcseconds south of the beamswitch base position.

3.1.2.5 *ra.s dec.s* TW.BS

Arguments:

ra.s is desired right ascension displacement in arcseconds.

dec.s is desired declination displacement in arcseconds.

Sets entered displacements in beamswitch thumbwheel locations as if the displacements were in the console thumbwheels. The displacements are positive for East and North. Subsequent beamswitch commands will cause the displacements to occur, such as pressing the beamswitch pushbutton or calling ABEAM or BBEAM. The right ascension displacement given is assumed to be an on-sky displacement, not coordinate difference. The value is divided by cosine(dec) prior to being applied to the telescope HA axis.

Example: 10.0 -20.0 TW.BS

Displacements of 10.0 arcseconds east and 20.0 arcseconds south will occur when ABEAM is called. The telescope will return to the beamswitch base position when BBEAM is called.

3.1.2.6 ?TW.BS

Returns the beamswitch displacements last entered in the thumbwheels. Assumes the associated pushbuttons were pressed at the IRTF so that the beamswitch thumbwheel data would be entered into the computer.

The units are tenths arcseconds, positive for North and East. The RA coordinate difference as applied to the telescope is derived by dividing the RA beamswitch thumbwheel data by cos(dec). Thus, the RA thumbwheel data represent the on-sky RA beamswitch displacement.

Returns:

Current thumbwheel beamswitch data as follows-

RA	DEC	
sss.s	*sss.s*	**`–OK`**

Example: ?TW.BS

Returns from the TCS-

```
–5.0  20.0  –OK
```

The return says that the data in the beamswitch thumbwheels is 5.0 arcseconds west and 20.0 arcseconds north relative to the beamswitch base position.

3.1.3 Offset commands

3.1.3.1 *n* DO.OFFST

Argument:

n=0 for requesting immediate reply.

n=1 for requesting wait for current offset to complete.

Causes the telescope to offset the amount entered in the offset thumbwheels relative to the base offset position. (If the telescope is already at that position, nothing happens.)

Nothing is returned from the TCS, except the usual **`–OK`**.

3.1.3.2 *n* –DO.OFFST

Argument:

n=0 for requesting immediate reply.

n=1 for requesting wait for current offset to complete.

Places the telescope back to the offset base position. If it is already there, nothing happens.

Only the **–OK** is returned from the TCS.

3.1.3.3 ?OFFST

Returns the current offset position as a displacement from the offset base position. The units are tenths arcseconds, positive for North and East. The RA offset coordinate difference has been multiplied by cos(dec) to produce the returned on-sky RA beamswitch displacement.

Returns:

Current telescope offset displacement (after any pending offset motion) as follows-

RA	DEC	
sss.s	*sss.s*	**–OK**

Example: ?OFFST

Returns from the TCS-

44.6 –211.5 –OK

The return says that the telescope is currently 44.6 arseconds west and 211.5 arcseconds south of the offset base position.

3.1.3.4 *ra.s dec.s* TW.OFFST

Arguments:

ra.s is desired right ascension displacement in arcseconds.

dec.s is desired declination displacement in arcseconds.

Sets entered displacements in offset thumbwheel locations as if the displacements were in the console thumbwheels. The displacements are positive for East and North. Subsequent offset commands will cause the displacements to occur, such as pressing PB4 or calling **DO.OFFST** or **–DO.OFFST**. The right ascension displacement given is assumed to be an on-sky displacement, not coordinate difference. The value is divided by cosine(dec) prior to being applied to the telescope HA axis.

Example: 23.6 -41.8 TW.OFFST

Displacements of 23.6 arcseconds east and 41.8 arcseconds south will occur when Pushbutton 4 is pressed the first time, or *n* **DO.OFFST** is called. The telescope will return to the offset base position when Pushbutton 4 is pressed again or *n* **–DO.OFFST** is called.

3.1.3.5 ?TW.OFFST

Returns the offset thumbwheel settings as entered at the console or by calling **TW.OFFST**. The units are tenths arcseconds, positive for North and East. Note that at the IRTF the mechanical thumbwheels are not read; what is read are the memory locations that receive the thumbwheel data when the associated pushbutton is pressed.

Returns:

Console offset thumbwheel or keyboard-entered data, or equivalent entered with command **TW.OFFST**, as follows-

RA	DEC	
sss.s	*sss.s*	**-OK**

Example: **?TW.OFFST**

Returns from the TCS-

```
44.6  -211.5  -OK
```

The return says that the previously entered offset displacement data is 44.6 arcseconds west and 211.5 arcseconds south. The telescope would displace this far from the offset base position if Pushbutton 4 were pressed or command **DO.OFFST** given.

3.1.3.6 *ra.s dec.s* OFFSET

OFFSET takes ra and dec displacements in 10ths arcseconds and causes the offset to occur. An offset velocity other than the default maximum can be entered with **`rrr.r V-OFFST`** where *rrr.r* is the desired offset velocity in tenths arcseconds/sec. Once entered, that value of velocity will be used for all subsequent offsets.

If 0. 0. OFFSET is used, the telescope will return at full speed to the offset base position. Any current V-OFFST value won't be used. You can defeat this behavior by entering 0.1 0.1 OFFSET and then 0. 0. OFFSET.

3.1.4 Scan commands

3.1.4.1 *r sss.s sss.s c* C.SCN

Arguments:

r is a reply code:

r=0 for immediate reply.

r=1 to wait for this scan motion to complete before replying.

sss.s: RA arcseconds displacement, then dec arcseconds.

c is a command code:

c=0 for relative displacement.

c=1 for absolute displacement.

c= -1 to intitalize the current scan position without moving telescope (defines this as scan base position).

Displacements are positive for East and North. The displacement given for RA should be the on-sky displacement. This value will be divided by cos(dec) to produce a coordinate difference for output to the telescope.

Scanning patterns in the sky are done with this command. The scan motions are independent of offsetting or beamswitching. The displacements *sss.s* arcseconds are with respect to the scan base position when using 1 for argument *c*, and are with respect to the previous scan position when using 0 for this argument.

To specify the current telescope position as the scan base reference, -1 is used for argument *c*. In this case, the values of *sss.s* for RA and dec are “don’t care”.

To cause the telescope to *return* to the scan base position, the arguments should be *r* 0.0 0.0 1, where *r* is either 0 or 1.

Example: 1 21.3 -100.0 0 C.SCN

Returns the `-OK` from the TCS after the scan motion is complete. The telescope is moved 21.3 arcseconds east and 100.0 arcseconds south of its previous scan position.

3.1.4.2 ?SCAN

Returns the current scan position as a displacement from the telescope’s scan base position. The units are tenths arcseconds, positive for North and East. The RA coordinate difference has been multiplied by cos(dec) to produce the returned on-sky RA scan displacement.

Returns:

Current telescope scan displacement (after any pending scan motion) as follows-

RA	DEC	
sss.s	*sss.s*	`-OK`

Example: ?SCAN

Returns from the TCS-

```
216.8  49.3  -OK
```

The return says that the telescope is currently 216.8 arcseconds west and 49.3 arcseconds north of the beamswitch base position.

3.1.5 Peak commands

3.1.5.1 *r sss.s sss.s c* C.PEAK

Arguments:

r is a reply code:

r=0 for immediate reply.

r=1 to wait for this peak motion to complete before replying.

sss.s: RA arcseconds displacement, then dec arcseconds.

c is a command code:

c=0 for relative displacement.

c=1 for absolute displacement.

c=-1 to initialize the current peak position without moving telescope (defines this as peak base position).

Displacements are positive for East and North. The displacement given for RA should be the on-sky displacement. This value will be divided by cos(dec) to produce a coordinate difference for output to the telescope.

Peak patterns in the sky are done with this command. The peak motions are independent of offsetting, beamswitching, or scanning. The displacements *sss.s* arcseconds are with respect to the peak base position when using 1 for argument *c*, and are with respect to the previous peak position when using 0 for this argument.

To specify the current telescope position as the peak base reference, -1 is used for argument *c*. In this case, the values of *sss.s* for RA and dec are "don't care".

To cause the telescope to *return* to the peak base position, the arguments should be *r* 0.0 0.0 1, where *r* is either 0 or 1.

Example: 1 4.5 -10.0 0 C.PEAK

Returns the **`-OK`** from the TCS after the peak motion is complete. The telescope is moved 4.5 arcseconds east and 10.0 arcseconds south of its previous peak position.

3.1.5.2 ?PEAK

Returns the current peak position as a displacement from the telescope's peak base position. The units are tenths arcseconds, positive for North and East. The RA coordinate difference has been multiplied by cos(dec) to produce the returned on-sky RA peak displacement.

Returns:

Current telescope peak displacement (after any pending peak motion) as follows-

RA	DEC	
sss.s	*sss.s*	**`-OK`**

Example: ?PEAK

Returns from the TCS-

```
86.3  29.7  -OK
```

The return says that the telescope is currently 86.3 arcseconds west and 29.7 arcseconds north of the peak base position.

3.1.6 Autoguider commands

3.1.6.1 *r sss.s sss.s c* C.AUTOG

Arguments:

r is a reply code:

r=0 for immediate reply.

r=1 to wait for this autoguider motion to complete before replying.

sss.s: RA arcseconds displacement, then dec arcseconds.

c is a command code:

c=0 for relative displacement.

c=1 for absolute displacement.

c= -1 to intitalize the current autoguider position without moving telescope (defines this as autoguider base position).

Displacements are positive for East and North. The displacement given for RA should be the on-sky displacement. This value will be divided by cos(dec) to produce a coordinate difference for output to the telescope.

Autoguider motions in the sky are done with this command. The autoguider motions are independent of offsetting, beamswitching, or scanning. The displacements *sss.s* arcseconds are with respect to the autoguider base position when using 1 for argument *c*, and are with respect to the previous autoguider position when using 0 for this argument.

To specify the current telescope position as the autoguider base reference, -1 is used for argument *c*. In this case, the values of *sss.s* for RA and dec are "don't care".

To cause the telescope to *return* to the autoguider base position, the arguments should be *r* 0.0 0.0 1, where *r* is either 0 or 1.

Example: 1 4.6 -1.4 0 C.AUTOG

Returns the `–OK` from the TCS after the autoguider motion is complete. The telescope is moved 4.6 arcseconds east and 1.4 arcseconds south of its previous autoguider position.

3.1.6.2 ?AUTOG

Returns the current autoguider position as a displacement from the telescope's autoguider base position. The units are tenths arcseconds, positive for North and East. The RA coordinate difference has been multiplied by cos(dec) to produce the returned on-sky RA autoguider displacement.

Returns:

Current telescope autoguider displacement (after any pending autoguider motion) as follows-

RA	DEC	
sss.s	*sss.s*	`–OK`

Example: ?AUTOG

Returns from the TCS-

`16.1   23.8   -OK`

The return says that the telescope is currently 16.1 arcseconds west and 23.8 arcseconds north of the beamswitch base position.

3.1.6.3 !V.AUTOG

Stores the given autoguider velocity in arcseconds/sec. This velocity will be resolved along the two axes when an autoguider displacement is executed. The RA component will be divided by cos(dec) so that the on-sky velocity is uniform anywhere in the sky. The entered velocity should be unsigned.

3.1.6.4 ?V.AUTOG

Returns the current autoguider velocity in arcseconds/second. Zero means maximum possible velocity.

Returns:

Current telescope autoguider velocity as follows: ***`v.s`*** **`-OK`**

Example: **?V.AUTOG**

Returns from the TCS: **`20.0 -OK`**

3.1.7 Tip-Tilt related commands

3.1.7.1 –OFST, +OFST

Used only by the Tip-Tilt software. Stops or enables communications from an external data acquisition program to go to the TCS. The Tip-Tilt software sees all TCS commands going over the communications link. Sometimes, for dithering for example, the Tip-Tilt system will want to inhibit data acquisition commands to the TCS and instead of letting the TCS move the telescope, use Tip-Tilt to shift the image. These two commands are specific to Tip-Tilt software and are not to be used by data acquisition programs. They are not programmed in Forth; they are defined in and only recognized by the *tcsd* daemon running in the workstation. They are included here for completeness.

3.1.7.2 POLL-OFB

Returns 1 if there is no offset from base motion, 0 if OFB motion is occuring. Used by the Tip-Tilt software. May also be used by data acquisition software to get around the “wait for motion complete” problem.

3.1.8 Other Commands

3.1.8.1 *hh:mm:ss.ss dd:mm:ss.s rpm.tttt dpm.sss yyyy.y* C.SLEW

Arguments:

Right ascension and declination coordinates, 10,000ths seconds time per year RA proper motion, 1,000ths arcsecond per year declination proper motion, epoch.

Provides the TCS with the coordinates and epoch for a desired object. The TCS applies the proper motion to the provided coordinates and reduces the mean coordinates to apparent. If the year is 0., the TCS assumes the provided coordinates are apparent. (Always use punctuation with the entered numbers.)

Return is immediate, without waiting for the TCS to slew to the object. Only the **-OK** is returned.

Example: 17:24:41.78 32:08:14.2 0.0461 0.184 1950.0 C.SLEW

3.1.8.2 C.HST

Returns civil HST in 50ths seconds in the format *tttttt*. The count goes up to 24 hours

3.1.8.3 C.STIME

Returns sidereal time in the format *hh:mm:ss.ss*.

Example: C.STIME

Returns from the TCS the sidereal time as follows:

```
8:41:19.83  -OK
```

3.1.8.4 ?DISP

Returns the current total displacement from the telescope base position, including beamswitch, offset, scan, and guiding. Waits for any currently active displacing to finish. The units are tenths arcseconds, positive for North and East. The RA coordinate difference has been multiplied by cos(dec) to produce the returned on-sky displacement.

Returns:

Current telescope displacement (after any pending displacement motion) as follows-

RA	DEC	
sss.s	*sss.s*	**-OK**

Example: ?DISP

Returns from the TCS:

```
44.6  -211.5  -OK
```

The return says that the telescope is currently 44.6 arseconds west and 211.5 arcseconds south of the base position.

3.1.8.5 PB8

Resets the current telescope position as the base position for all offset-from-base functions except SCAN. You need to explicity call **`C.SCN`** with the appropriate parameters to define the scan base position.

3.1.8.6 TCSINFO

Returns telescope status information. Equivalent to doing: **0 TPD C.STIME C.HST** . You get back the following TCS information:

RA DEC HA AIRMASS EPOCH STIME HST MOVING?

in the formats-
hh:mm:ss.ss dd:mm:ss.s hh:mm:ss.ss a.aaa yyyy.y hh:mm:ss.ss tttttt n

where the ***n*** is 0 if not moving on the sidereal sky, 1 if moving but not slewing, and 2 if in a slew.

4. PART IV

4.1 RS-232 Serial Port Connection

The protocol expected by the LSI-11 TCS from the remote computer is: no parity, 8 data bits, and 1 stop bit. Currently, the IRTF TCS is set to 9600 baud. You are advised to confirm the baud rate with the day crew.

Following is a description of the RS-232 signal lines at the remote computer end of the cable, as expected by the TCS computer.

Pin 2:

Transmit to TCS Receive (Pin 3).

Pin 3:

Receive from TCS Transmit (Pin 2).

Pin 4:

Request To Send (output) to TCS Clear To Send (Pin 5). Also jumpered to Pin 20, Data Terminal Ready. This signal is actively asserted and cleared by the remote computer, depending on whether or not the remote computer is ready to accept transmission from the TCS.

Pin 5:

Clear To Send (input) from TCS Request To Send (Pin 4). This signal is actively asserted and cleared by the TCS depending on whether or not the TCS is ready to accept transmission from the remote computer.

Pin 6:

Data Set Ready (input) from TCS Data Terminal Ready. Jumpered to Pin 8, Carrier Detect. This signal is permanently enabled while the TCS is on-line. It is not toggled as a handshake. The remote computer can use this signal to sense the presence of the TCS.

Pin 7:

Common. Connected to Pin 7 at the TCS.

Pin 8:

Carrier Detect (input). Jumpered to Pin 6. Senses Data Terminal Ready from TCS.

Pin 20:

Data Terminal Ready (output). Jumpered to Pin 4. Not connected to TCS. This signal is available for any equipment that wants to utilize DTR for handshaking.

4.2 TCS RS-232 Serial Port Cable

External (DTE) DB25-S (Female)			LSI-11/23 (DCE) Berg or 3M 40-pin		
			↓	↓	
Braided shield	**1**	—— •			
Xmit	**2**	>————————————▶	**J**	**8**	Rcv
Rcv	**3**	◀————————————<	**F**	**6**	Xmit
Req. To Send	**4**	>————————————▶	**T**	**16**	Clear To Send
Clear To Send	**5**	◀————————————<	**V**	**18**	Req. To Send
Common	**7**	————————————	**A**	**1**	Common
Data Set Ready	**6**	┌ ◀——————————< ┐	**DD**	**26**	Data Terminal Ready
Carier Detect	**8**	└ • (Jumpered) (Jumpered) • ┘	**BB**	**24**	Carrier Detect
		┌ •	**M**	**11**	EIA interlock
		(Jumpered) └ •	**E**	**5**	

5. INDEX