V-06 OBC Opened Node Timing Test

ENGINEER: _____Braccio/ Sullivan_____

DATE: _____

COMMENTS:
You will need the following to perform this test:
1) Science cable
2) Timing Signal receiver board

MARS
Org: WHOI
Engr: Al Bradley
Fritz Sonnichsen
Date: 05/18/05

V-06 OBC Opened Node Timing Test

The ability to port a timing signal with a jitter of less than 1 microsecond over the OBC must be proven.

The required equipment for this test is:

1) oscilloscope
2) OBC Shore Station
3) OBC Sub Sea Assembly
4) Laptop Configured with Timing Test Software and an asynch terminal

VORSICHT:

WHENEVER CONNECTING OBC TRANSPONDERS TO THE SUB-SEA UNIT, ALWAYS POWER DOWN THE UNIT TO AVOID DAMAGE DUE TO TRANSIENTS

V-06 OBC Opened Node Timing Test

NOTE

The following tests were originally written with manual command line methods for communicating with the timing distribution system. However recent devlopements (as of 3/3/07) have provided menus which facilitate this test.
We are leaving the original doc here for reference however:

Skip any sections marked “SKIP” in this document. The section labled “menu method” near page 12 will show you how to initialize the TD system when you get to that point.

V-06 OBC Opened Node Timing Test

Procedure

1) For initial checkup, after connecting the East A&B and the West A&B shore fibers to their corresponding transponders in the sub-sea unit issue help commands to each device to check it's operation. Needless to say you wil need an RS232 connection to each port (East A,B and West A,B) on the shore stations. MAKE SURE THE MONITORING FUNCTIONS OF THE OPERATIONS CONSOLE ARE SHUT DOWN SINCE THEY USE THE SAME PORTS AS THE TIMING SYSTEM

Check Shore East or West A side
###CKAH

Check Shore East or West B side
###CKBH

Sub-sea East or West A side
###S01AH

Sub-sea Esat or West B side (clock)
###C01BH

Sub-sea East or West A side (clock)
###C01AH

Sub-sea Esat or West B side
###S01BH

In the event or problems a simple optical test can be performed:
1) Insert an optical power meter (1550nm) at the fiber end which connects to a sub-sea transponder
2) From an ASCII terminal connected to the shore station send continiuous character strings
3) Expect about -35 to -45 dBm

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Procedure

1) Connect the OBC sub-sea and shore units as shown in the setup sheets,

2) Using the set1a,b set2 and set3 pages, test the signal jitter with an oscilloscope connecting oscilloscope probes as shown

3) The square wave signals should appear once per second with a jitter of less than 3 microseconds measure from the trailing edge as shown below

4) Capture and record the results.

2) Connect an asynch terminal to either RS232 DCE port of the west shore node on the A side. Use no-flow and 8N1

3) Make sure the GPS is sync'd with the satellite. Using the async terminal issue:

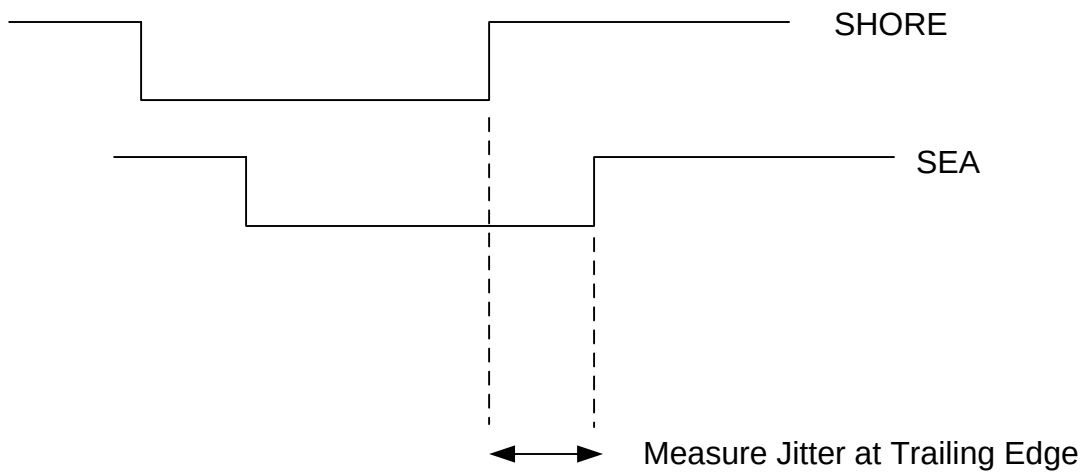
#CKA

?G

The GPS string should contain an A at the location shown. A V means that it is not synch'd with the satellite:

GPRMC,203329,***A***,4131.5204,N,07039.9853,W,0.000,0.0,200505,16.1,W*45

4) Set the clocks using the commands shown on the next page



V-06 OBC Opened Node Timing Test-Setting the Time Offset

MEASURING and SETTING CLOCK DELAY

Expect an offset of (1sec x 2 x 10^8 ms^{-1})(fiber-length m)

STEP1: SYNC GPS TO THE SHORE CLOCK
#CKA address the shore clock
!GS have it send a #[gps-time]@ on the second and then unaddress
#CKA!S1 turn GPS sync on

STEP2: SYNC SEA TO SHORE CLOCK
#C01A address the sea clock
!T set in time mode
#CKA address the shore clock
?T have shore clock send the time
#C01A re-address the sea clock
?T display the sea clock time

STEP 3: LOG THE CURRENT SEA AND SHORE CLOCK TIMES
#CKA address the shore clock
!EC01A<cr> sends a #C01A!E@ to the SEA clock and then unadresses. This will cause the SEA clock to Echo an @ back
#CKA re-address the shore clock
?L2 display last two entries in the log
The log simply writes a timestamp anytime it sees an @. In this case the @ sent by the shore (CKA) writes the first entry and the one sent back from C01A writes the second entry

STEP 4: CALCULATE THE RELATIVE TIME OFFSET FROM SEA TO SHORE
the log will contain 2 lines with the times reported by the sea and shore clocks:
0000 19:49:19.590766
0000 19:49:19.576920
diff = (difference of times above) = 13846
round-trip = diff - 0.013333 = 513 (where 0.013333 is the pre programed delay for ring-around)
light-delay = round-trip / 2 = 256

STEP5: SET SEA CLOCK DELAY
#C01A address the SEA clock
?O display offset
!O0256 set light-delay from above

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STEP6: Repeat the commands for the WEST B side using address:
CKB for the shore
C01B for the subsea

SUMMARY OF TIMING COMMANDS ISSUED TO CLOCKS

SHORE - #CKA #CKB

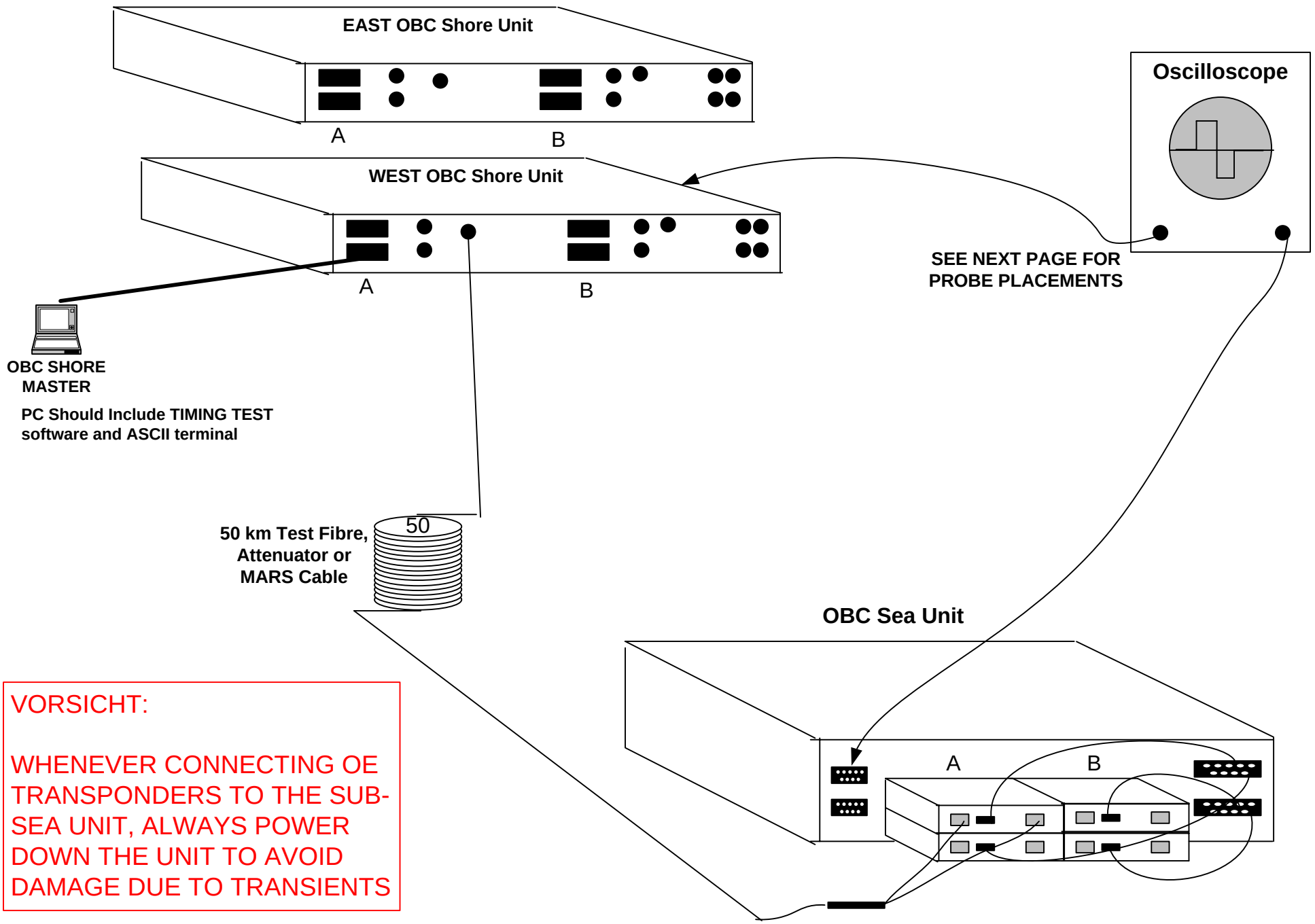
?T show real time clock value (not GPS)
?G determine if GPS is running V=no A=yes
?S show sync flag status
!S1 turn sync on
!T set clock
!S turn on sync flag after boot
?Ln display n log entries

SEA - #C01A #C01B

A locking status P gies (tiller – 6811 output)
!Q reset integrator
!T#CKA?T set the SEA clock to the value transmitted by the shore clock
!Tabcdefghij@ set the clock to time abcedfghij

V-06 OBC Opened Node Timing Test – SHORE to SUBSEA OBC

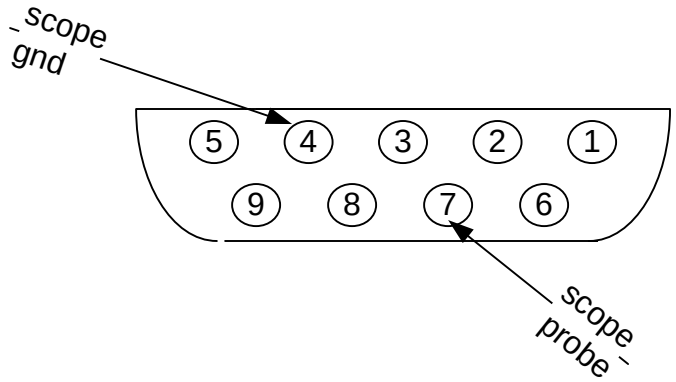
SEE NEXT PAGE FOR OSCILLOSCOPE TEST POINTS



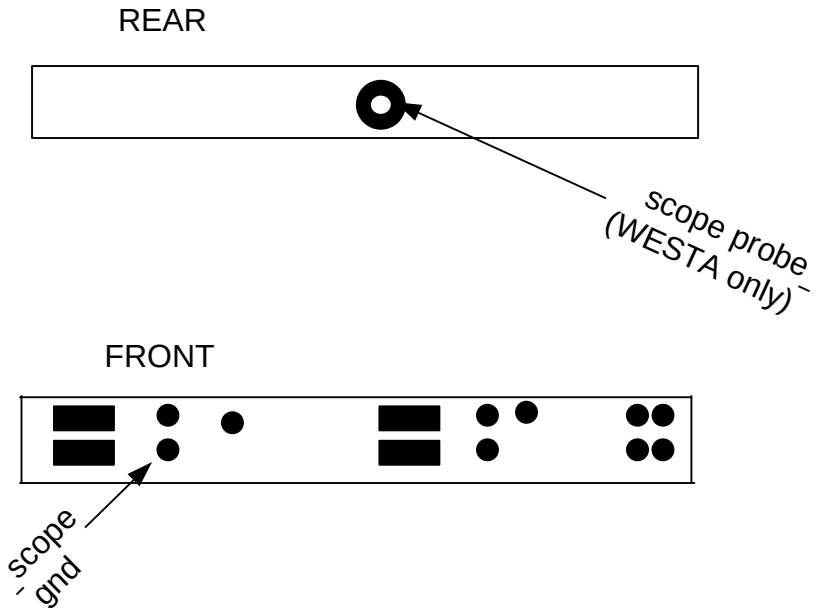
VORSICHT:

WHENEVER CONNECTING OE TRANSPONDERS TO THE SUB-SEA UNIT, ALWAYS POWER DOWN THE UNIT TO AVOID DAMAGE DUE TO TRANSIENTS

V-06 OBC Opened Node Timing Test - Setup

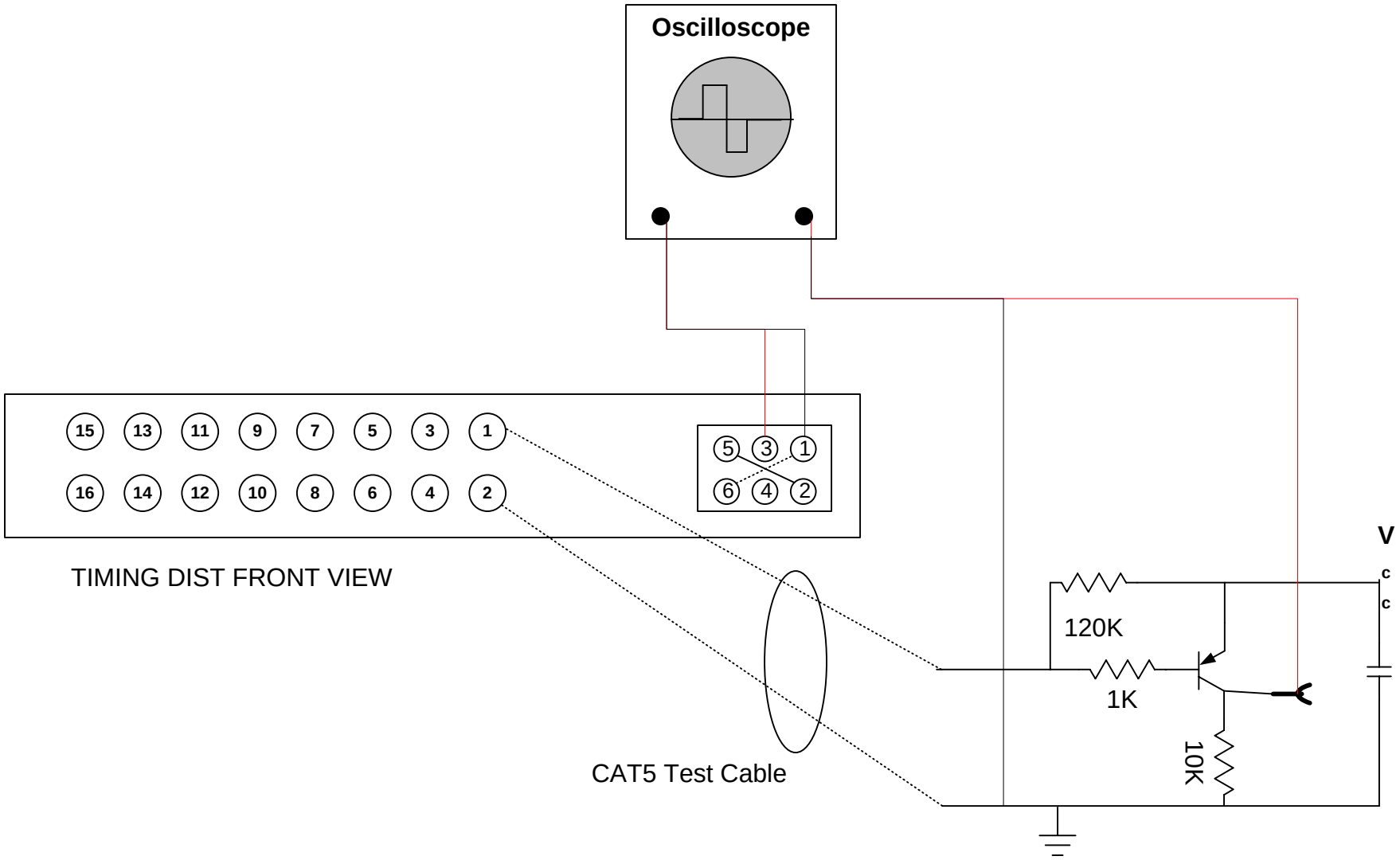


Probe points: J1-Time connector on OBC sub-sea unit

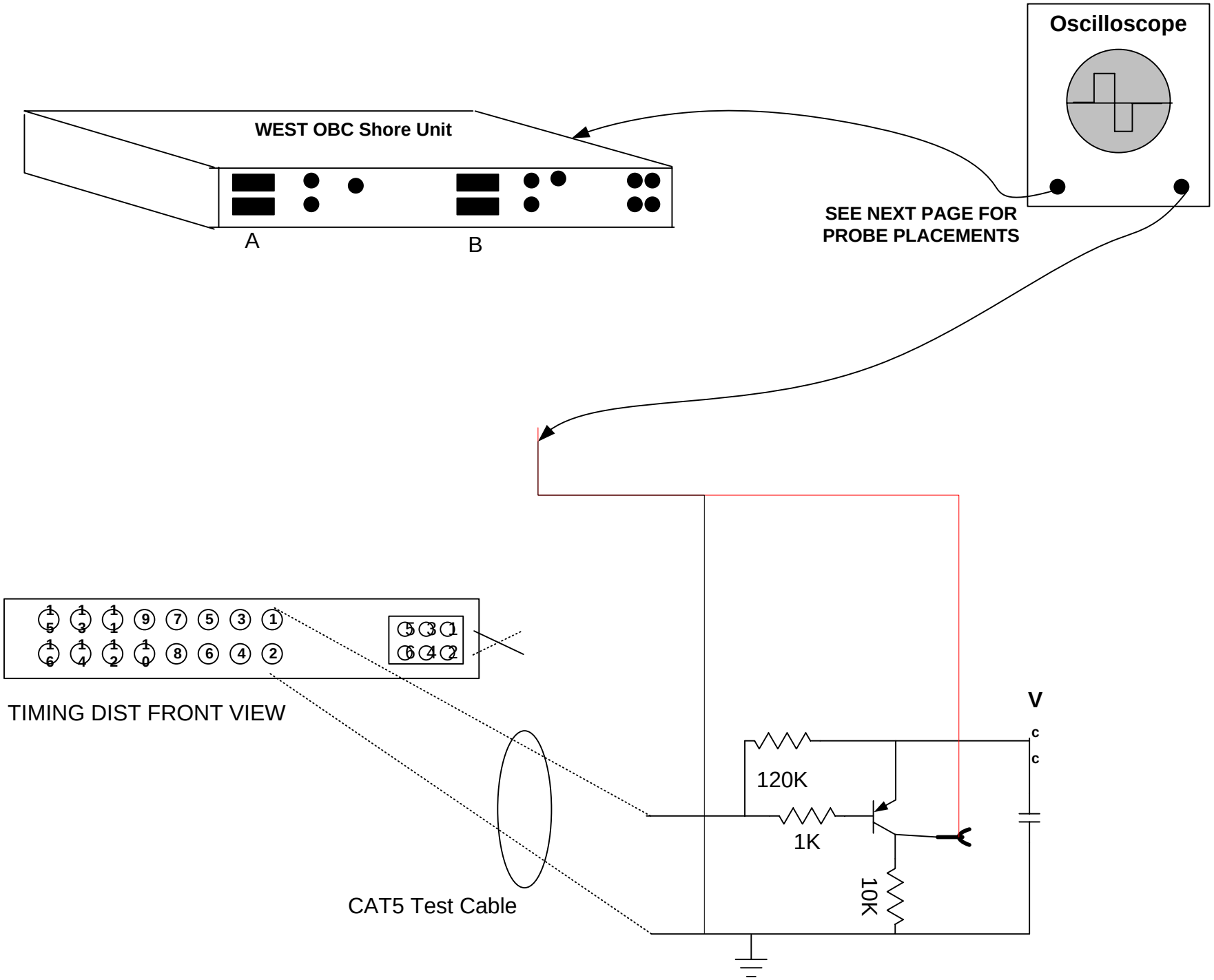


Probe points: With shore station open

V-06 OBC Opened Node Timing Test-TIMING DIST to SCIENCE RECIEVER



V-06 OBC Opened Node Timing Test – SHORE to Science Receiver



V-06 OBC Opened Node Timing Test – MENU METHOD

```
Mars High Precision Timing - v1.20050826
   ShoreClock: #CKA  NodeClock: #C01A

   x) eXit  a) use ShoreClockAddr  b) use NodeClockAddr  c) use nsec
   1) View Shore Clock Time
   2) Set  Shore Clock Time
   3) View Node Clock Time
   4) Set Output Relay
   5) Get Propagation Delay (Latency)
   6) Set Propagation Delay Offset
   7) Syncronize Node Clock to Shore Clock
   8) Send Global Sync
   9) Get Timing Statistics (and send-out !GS every 10 sec)
  10) View node clock P,X,I values
  11) View node clock Latency Offset Value
  12) Set   GPS Sync
  13) UnSet GPS Sync
  14) View  GPS Sync
  15) View GPS String

Enter Option Number: 1
RET=#CKA?T= 0005 09:48:14...À:
#CKA?L1
 0005 09:48:14.000002
:

Enter Option Number: 2
Enter DateTimeStr [dddd hh:mm:ss]: 0005 06:53:30
RET=#CKA!T0005 06:53:30@


Enter Option Number: 3
RET=#C01A?T= 0000 10:23:43...À:
#CKA?L1
 0005 06:53:45.788056
```

From the marsdcs server start the timing distribution menu. Walk through the menu step by step seuquentilly. The results shown below are examples of proper output from the menu.

V-06 OBC Opened Node Timing Test – MENU METHOD

Enter Option Number: 4
RET=#C01A!SR

Enter Option Number: 5
RET=#CKA?L2
0005 06:54:07.423441
0005 06:54:07.409593
:

OFFSET = 257.5

Enter Option Number: 6
Enter Latency microseconds (0-5000): 257
RET=#C01A!O0257
:

Enter Option Number: 7
RET=#C01A!T#CKA?T= 0005 06:54:42...À:

Enter Option Number: 8
RET=#CKA!GS... #GÀ

Enter Option Number: 10
RET=#C01AA P= 0002 T= 0000 TP= 2666,C09B,0CF4 I= 0000,005B,0D08
:

Enter Option Number: 11
RET=#C01A?O 0257
:

Enter Option Number: 12
RET=#CKA!S1
:

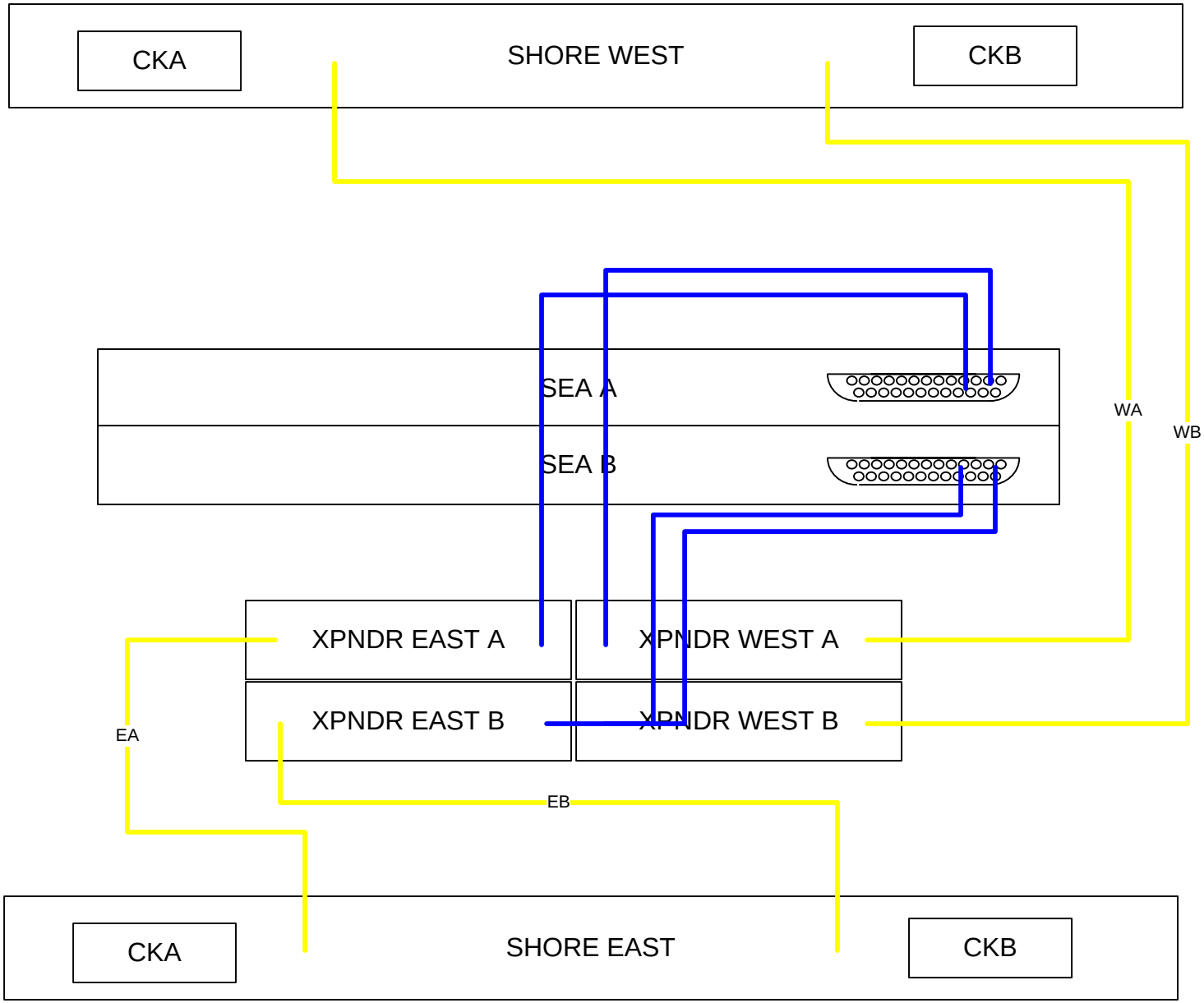
Enter Option Number: 14
RET=#CKA?Sync Flag in ON, GPS is NOT valid!
:

V-06 OBC Opened Node Timing Test – MENU METHOD

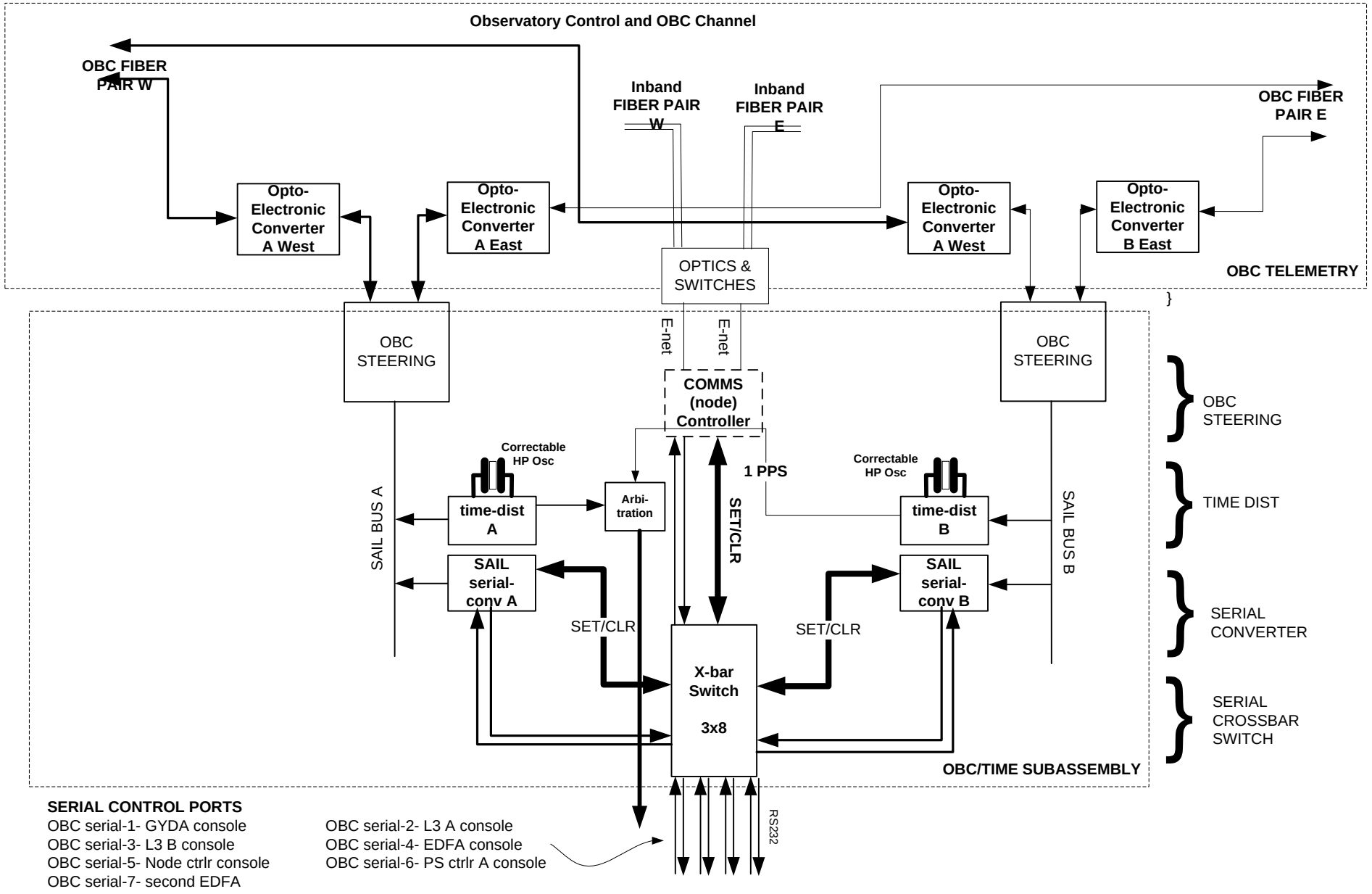
Enter Option Number: 15
RET=#CKA?GPRMC,095836,V,3648.1852,N,12147.2613,W,0.000,0.0,040797,15.3,E*49
:

Enter Option Number: 9
Node Latency Offset = [0257]
sending global sync
waiting 10 seconds...
#CKA=[0005 06:56:17.000003] #C01A=[000293] jitter=[33]
sending global sync
waiting 10 seconds...

V-06 OBC Opened Node Timing Test – Architecture Summary



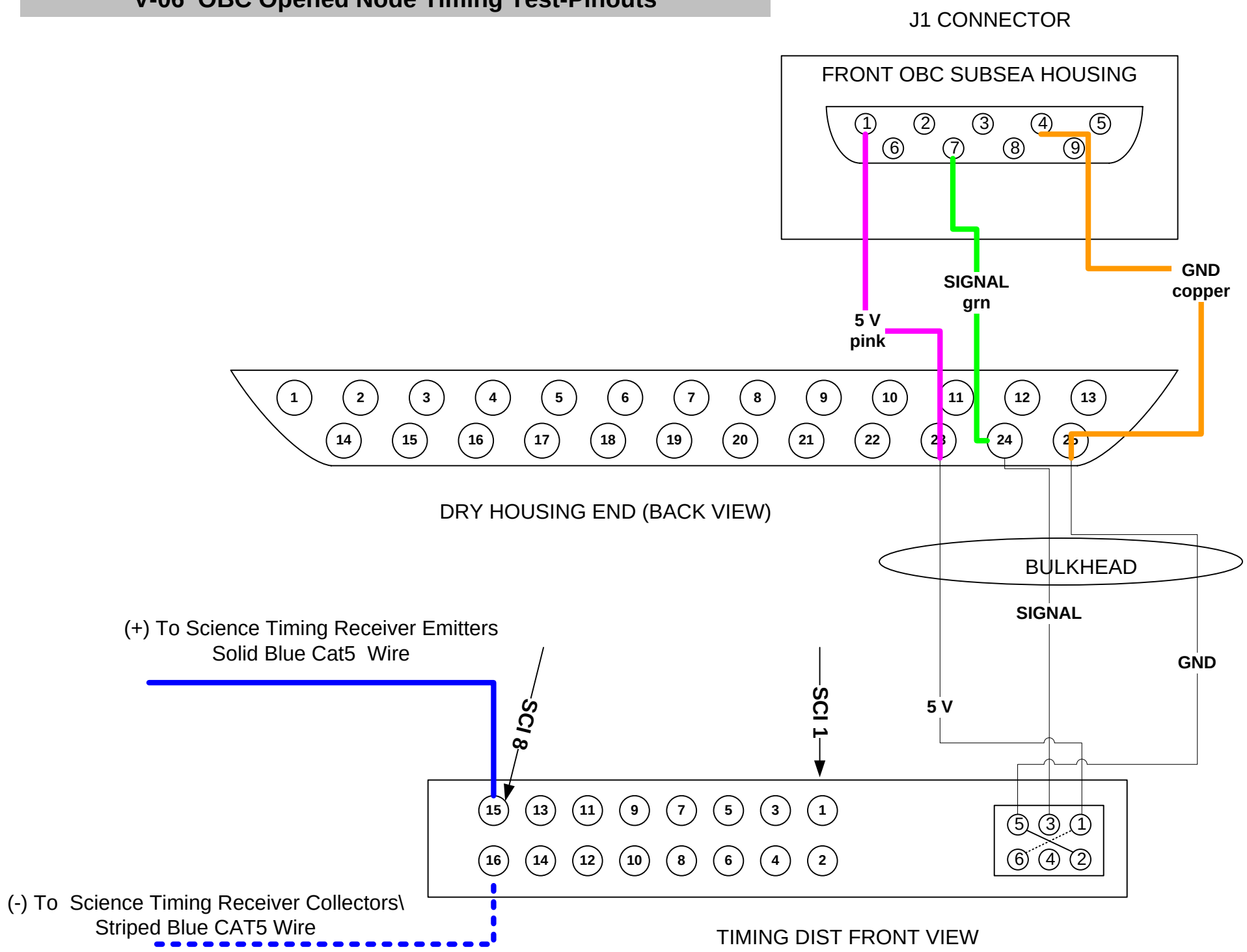
OBC Architecture - Block Diagram for One Node



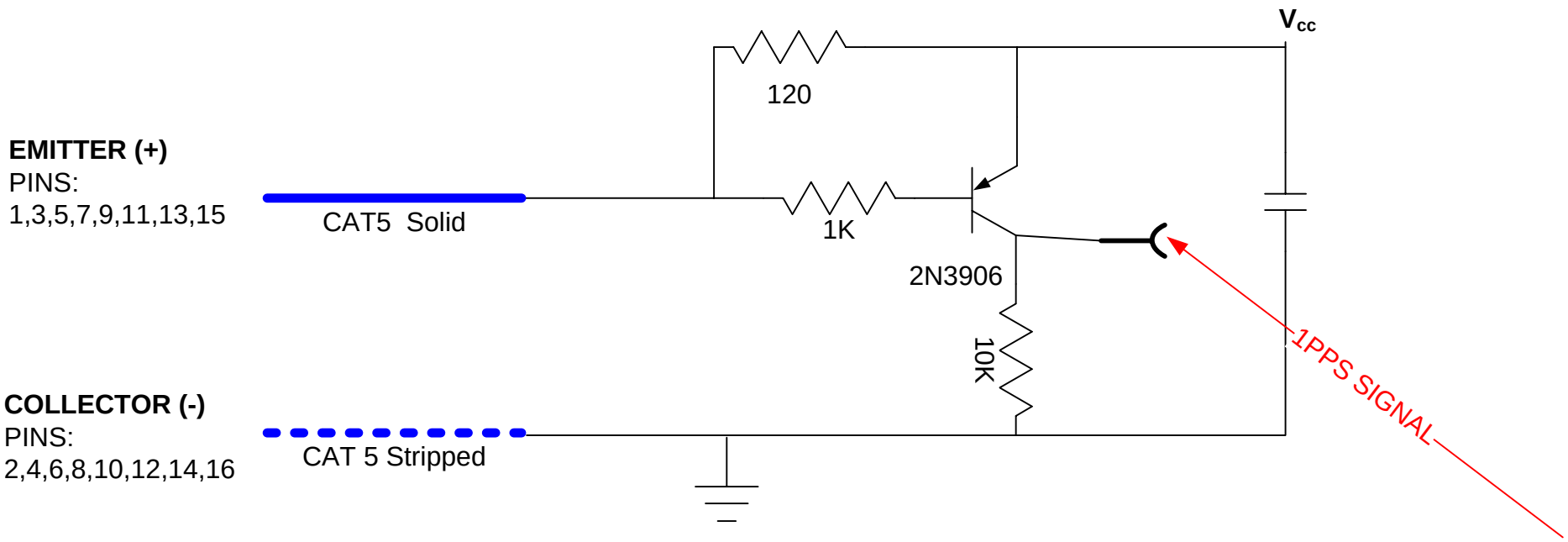
SERIAL CONTROL PORTS

OBC serial-1- GYDA console
OBC serial-2- L3 A console
OBC serial-3- L3 B console
OBC serial-4- EDFA console
OBC serial-5- Node ctrlr console
OBC serial-6- PS ctrlr A console
OBC serial-7- second EDFA

V-06 OBC Opened Node Timing Test-Pinouts



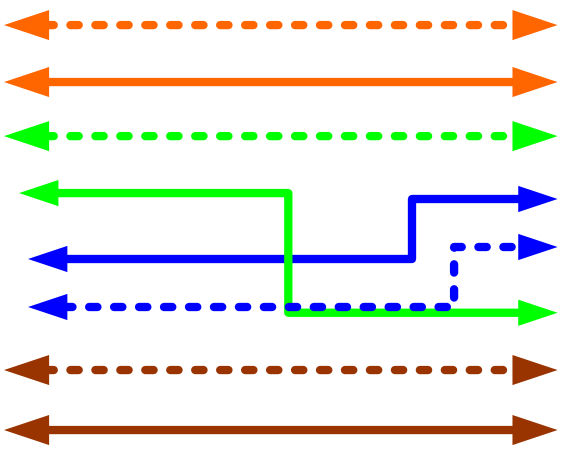
V-06 OBC Opened Node Timing Test-Science Timing Pulse Receiver

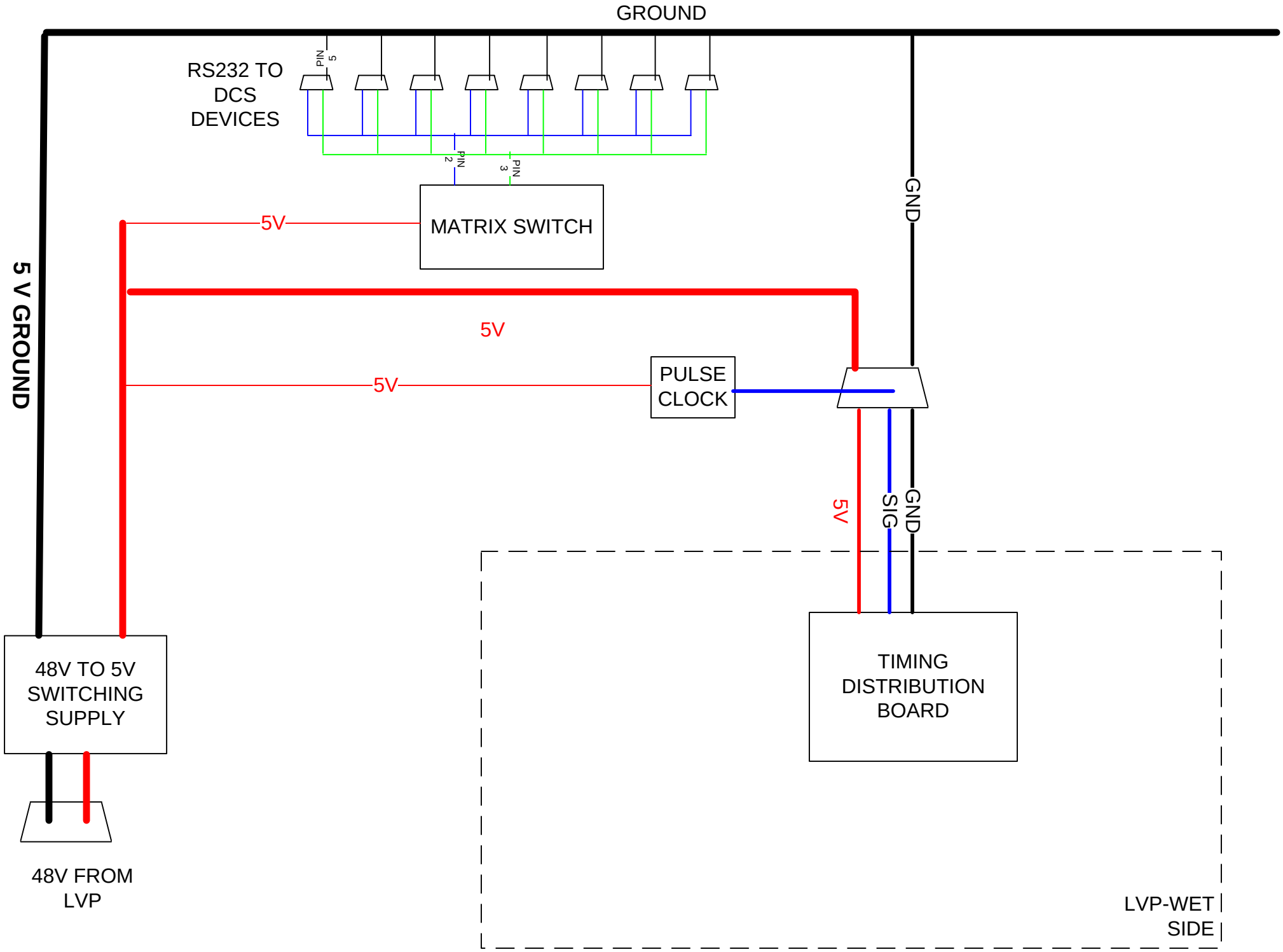


V-06 OBC Opened Node Timing Test-Science Wet Connector Pinout

ETHERNET RJ45 T568B at SCIENCE INSTRUMENT

WET CONNECTOR

01	Orange White	Tx+		01	Orange White	Tx+
02	Orange	Tx-		02	Orange	Tx-
03	Green White	Rx+		03	Green White	Rx+
04	Green	Rx-		04	Blue	Rx-
05	Blue	TD+		05	Blue White	TD+
06	Blue White	TD-		06	Green	TD-
07	Brown White	n/a		07	Brown White	n/a
08	Brown	n/a		08	Brown	n/a
09	white	400V-				
10	white	400V+				
11	white	48V+				
12	white	48V-				


GROUND
RS232 TO
DCS
DEVICES
PIN
5
PIN
2
PIN
3
MATRIX SWITCH
5V
GND
5 V GROUND
5V
5V
PULSE
CLOCK
5V
SIG
GND
48V TO 5V
SWITCHING
SUPPLY
TIMING
DISTRIBUTION
BOARD
48V FROM
LVP
LVP-WET
SIDE

V-06 OBC Opened Node Timing Test

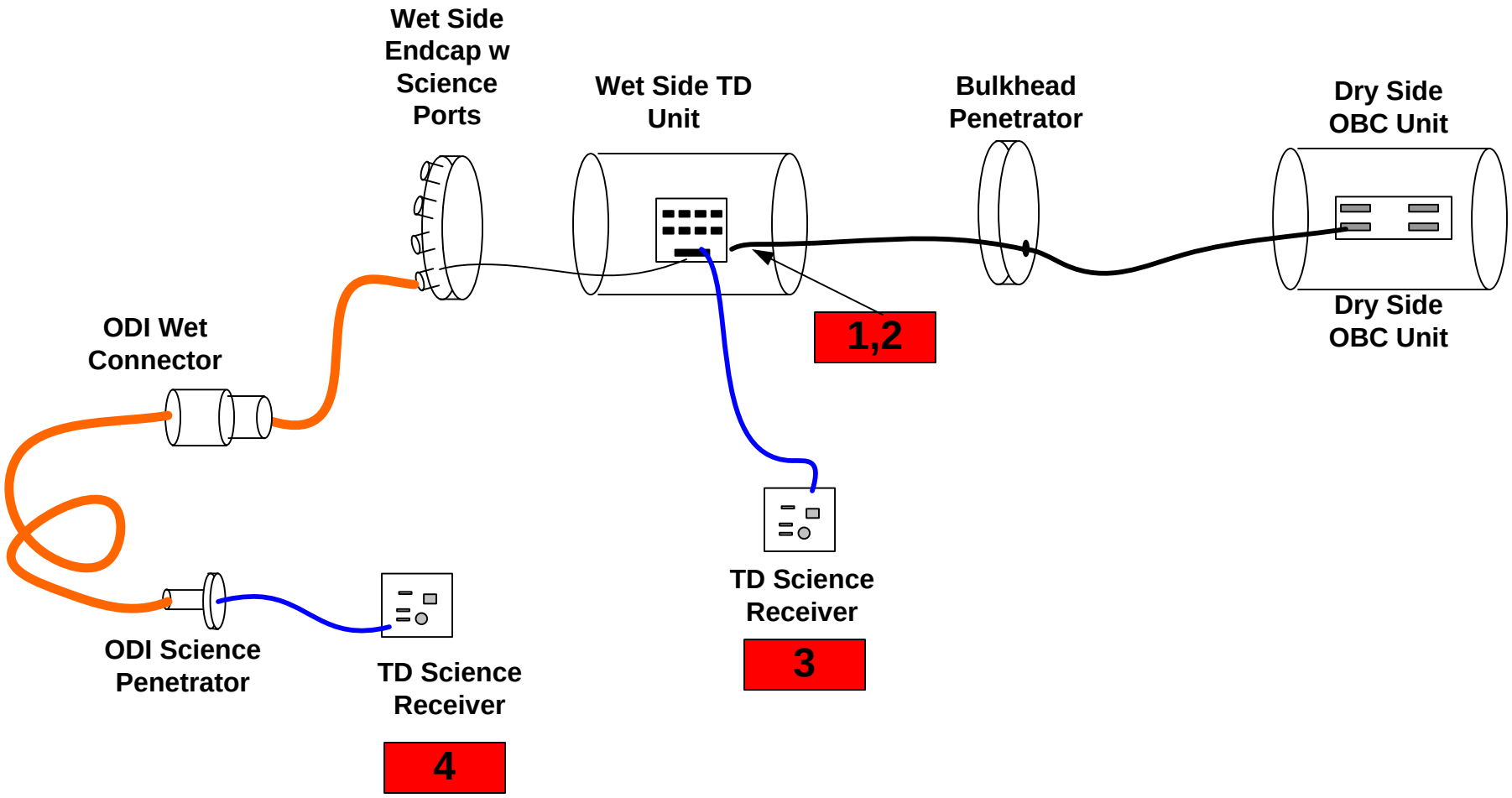
SNAP OF SHORE CLOCK HELP SCREEN

```
:  Help C01A Fri, Apr 1, 2005, 10:25
!T, ?T  To set, disp RTC. (dddd hh mm ss then @)
!E@ echos @ 10ms+DELAY later
!UNLOCK allow memory writes and ramtest
?L see LOCK state
!Dhhhh, ?D set/see reply DELAY
!Odddd, ?O set see RTC offset, microseconds
!SR Set Output Relay
?V see 4 voltages
!A Avoid deadman timout
!Q Quick Lock
A see All lock variables
 P see TPDIFF
 X see eXternal pulse (DTIC3-DTOC2)
 I see TPINT
!Jhhhh jump internal phase by hhhh
!Ihhhhhhhhhhhh Jam phase Integrator
+Monitor w ?C, ?R
:
```

SNAP OF SEA CLOCK HELP SCREEN

```
:  Help CKA 2.2 Thu, Apr 14, 2005, 11:34
!T, ?T  To set, see RTC. (dddd hh mm ss then @)
!UNLOCK allow memory writes and ramtest
!Dhhhh, ?D set/see DELAY
?Ln see n (=1:7) last LOG entries
!GS sends (pound)G@ on sec, unaddresses
!Ecccc[cr] sends (pound)cccc!E@, unaddresses
?S see, !Sb b=1/0, GPS sync on/off
?G see GPS string
+Monitor w ?C, ?R
:
```

V-06 OBC Opened Node Timing Test



Test Points Shown in RED:

1) Power Source at Input to TD Board
2) Timing Pulse at Input to TD Board
3) Timing Pulse Directly From Output of TD Board
4) Timing Pulse at Science Penetrator

V-06 OBC Opened Node Timing Test

POWER SOURCE INPUT TO TD BOARD AT THE WET SIDE

1

TD SIGNAL FROM DRY SIDE MEASURED AT INPUT TO TD BOARD ON THE WET SIDE (Measured with TD Science Receiver Circuit)

2

TD OUT SIGNAL PORT 5 FROM WET SIDE (Measured with TD Science Receiver Circuit)

3

V-06 OBC Opened Node Timing Test

TD Signal Measured at Science Penetrator after Passing Through ODI Cable (No Ethernet Acitve) NOTE NOISE

4