

Appendix

Using the Master/Slave Setup

Z-1 Introduction

A standard Workhorse ADCP with version 8.19 firmware and higher has the capability to be turned into a “Master” or “Slave” ADCP. The basic idea is that the Master ADCP sends a synchronizing pulse to the Slave ADCP to tell it when to start a ping or ensemble.

If you are synchronizing pings with another instrument, you need to determine whether or not that instrument can accept or send the trigger pulse. If the instrument can accept the trigger, but has no way to send out a trigger signal, you would set the ADCP as the master.

The actual setup of each ADCP (Master or Slave) is independent of this feature. This means if you are using two ADCPs, that the Slave ADCP can have a setup that is identical or completely different from that of the Master ADCP. The Master and Slave ADCPs can be setup such that they ping at the same time from the synchronization pulse or so that they actually alternate pings. This control depends entirely on how you setup the Master and Slave ADCP command files.

The ADCP is set as a Master or Slave ADCP via the SM-command. Once an ADCP has been set as the Slave ADCP, use the ST-command to tell the Slave ADCP how long to wait for a synchronizing pulse before timing out. This feature is added in case the cable between the Master and Slave ADCP was to fail, or if the Master ADCP was to fail.

There are a series of commands that are used to tell the Master ADCP when to send a synchronization pulse and when to wait if it is a Slave ADCP (i.e., before a ping, after a ping, before an ensemble, or after ensemble). The Master ADCP can also be told to send the synchronization pulse and then delay before it continues to perform its own ping cycle/ensemble.

The Master/Slave function uses the RS-485 bus to communicate between the instruments. There are three lines used to send the 20-millisecond break (a ground wire and the 2-data wires). One will transition from High to Low and the other will transition from Low to High. They will remain in that state for 20 milliseconds, then transition back to the quiescent states. The voltage of both lines with respect to the Communication Ground is 0 to 5VDC.

Z-2 Requirements

The following is a list of minimum requirements when using the Master/Slave Workhorse setup.

Using Two ADCPs

- Two Workhorse ADCPs that have firmware version 8.19 or higher
- Special Master/Slave Cable that allows each ADCP to talk to each other
- Both Workhorse ADCPs must be setup in RS232 Mode

Using One ADCP and Another Instrument

- Workhorse ADCP that has firmware version 8.19 or higher
- Special Master/Slave Cable that allows the ADCP to talk to other instrument
- Special pigtail cable to other instrument
- Workhorse ADCP must be setup in RS232 Mode
- Another instrument capable of accepting the 20ms trigger pulse

Z-3 Examples

Example 1 shows the basic steps used to configure two Workhorse ADCPs in a Master/Slave setup. In this example we will assume that you will use the same setup for each ADCP and the systems will ping simultaneously.

Example 2 shows how to set the ADCP as a master and the trigger requirements for another instrument.

Z-3.1 Example 1 - Using 2 ADCPs

Basic Setup

The basic commands for the Master and Slave ADCP setups are no different from a “standard” deployment. You should use the *PLAN* program to select the number of bins, bin size, number of pings, ensemble duration, etc. This will give you the “basic” commands needed to collect data.

The following is a basic set of commands that may be used for each ADCP:

- 30 bins
- 4 meter bins
- 45 ping per ensemble (note: this is the default setup, set as you would like.)
- 1-hour ensemble interval (note: this is the default setup, set as you would like.)
- 1 day for the deployment length (this is set just to get an idea of the battery usage per day)
- 0 meters for the transducer depth

- 35ppt
- set the magnetic variation as required
- ping immediately after deploy
- record data internally

Once you have created the basic configuration file exit the *PLAN* program and copy the file to different files. Name one of the files MASTER.CMD and the other SLAVE.CMD.

Master Setup

There are seven commands that must be added to the Master ADCP command file. Edit the MASTER.CMD command file you created using a standard text editor (i.e., DOS Edit or NotePad).

Add the following commands to the MASTR.CMD file. Remember that the following example shows the basic steps used to configure two Workhorse ADCPs in a Master/Slave setup. In the following example we will assume that you will use the same setup for each ADCP and the systems will ping simultaneously. These commands must be added in the file before the CK command. We suggest you follow the same format as the rest of the commands and include the line with the semi-colon.

Table Z-1. Master Command File Added Commands

Command	Description
SM1	Sets the Workhorse ADCP as the Master
SA001	Send a synchronizing pulse before each ping
SI0	Sets how many pings per ensemble you will send a synchronizing pulse for; zero sends a pulse after every ping (typical default setting is used here)
SW75	Sets the number of milliseconds to wait before the Master starts its' ping, a 75 millisecond setting will ensure that both the Master and Slave will ping within 100 microseconds of each other
\$LMR.TXT	Used by <i>BBTALK</i> to turn on the capture of all communications between the ADCP and the computer to a file called MR.TXT. Do not include if you intend to use another RDI supplied deployment software package.
\$D3	Used by <i>BBTALK</i> to delay for 3 seconds before continuing to the next command. Required during the deployment sequence using <i>BBTALK</i> . Do not include if you intend to use another RDI supplied deployment software package.
\$X	Used by <i>BBTALK</i> to exit from the <i>BBTALK</i> program. Do not include if you intend to use another RDI supplied deployment software package.



NOTE. Once the commands have been added to the CMD file, you will not be able to load this file into the PLAN program. The PLAN program will only handle "standard" commands.

Example of the modified Master command file.

```
$LMR.TXT          WILL CAPTURE ALL COMMUNICATIONS TO A FILE TITLED MR.TXT
; CR1
CR1
$D3              WILL DELAY THE BBTALK PROGRAM 3 SECONDS BEFORE GOING TO NEXT COMMAND
; ED0000
ED0000
; ES35
ES35
; EX11111
EX11111
; SM1           SET AS MASTER ADCP
SM1
; SA001        SYNCHRONIZING PULSE BEFORE EACH PING
SA001
; SI0          SYNCHRONIZING PULSE SENT ON EVERY PING
SI0
; SW75         WAIT 75 MILLISECONDS
SW75
; TE01:00:00.00 PLAN DEFAULT SETUP SHOWN
TE01:00:00.00
; TP01:19.98   PLAN DEFAULT SETUP SHOWN
TP01:19.98
; WD111100000
WD111100000
; WP00045      PLAN DEFAULT SETUP SHOWN
WP00045
; WN030
WN030
; WS0400
WS0400
; WF0176
WF0176
; WV170
WV170
; EZ11111111
EZ11111111
; EA00000
EA00000
; EB00000
EB00000
; CF11101
CF11101
; CK
CK
$D3              WILL DELAY THE BBTALK PROGRAM 3 SECONDS BEFORE GOING TO NEXT COMMAND
; CS
CS
$L              WILL CLOSE THE FILE MR.TXT
$D3              WILL DELAY THE BBTALK PROGRAM 3 SECONDS BEFORE GOING TO NEXT COMMAND
$X              WILL EXIT FROM BBTALK
```

```
;Created as: MASTER.CMD (1997/10/15 10:50:22.58  PLAN Version 1.30 )
;Deployment hours = 24.00
;Temperature     = 5.00
;Frequency       = 307200.00
```

Slave Setup

There are six commands that must be added to the Slave ADCP command file. Edit the SLAVE.CMD command file you created using a standard text editor (i.e., DOS Edit or NotePad).

Add the following commands to the SLAVE.CMD file. These commands must be added in the file before the CK command. We suggest you follow the same format as the rest of the commands and include the line with the semi-colon.

Table Z-2. Slave Command File Added Commands

Command	Description
SM2	Sets the Workhorse ADCP as the Slave
SA001	Slave ADCP will wait to ping before each ping
ST0300	Sets the Workhorse ADCP to wait up to 300 seconds for the synchronization pulse. If there is a problem the slave will still ping once every 300 seconds)
\$LSV.TXT	Used by <i>BBTALK</i> to turn on the capture of all communications between ADCP and computer to a file called SV.TXT. Do not include if you intend to use another RDI supplied deployment software package.
\$D3	Used by <i>BBTALK</i> to delay for 3 seconds before continuing to the next command. Required during the deployment sequence using <i>BBTALK</i> . Do not include if you intend to use another RDI supplied deployment software package.
\$X	Used by <i>BBTALK</i> to exit from <i>BBTALK</i> program. Do not include if you intend to use another RDI supplied deployment software package.



NOTE. Once these commands have been added to the CMD file, you will not be able to load this file into the PLAN program. The PLAN program will only handle “standard” commands.

Example of the modified Slave command file

```
$LSV.TXT          WILL CAPTURE ALL COMMUNICATIONS TO A FILE TITLED SV.TXT
; CR1
CR1
$D3              WILL DELAY THE BBTALK PROGRAM 3 SECONDS BEFORE GOING TO NEXT COMMAND
; ED0000
ED0000
; ES35
ES35
; EX11111
EX11111
; SM2           SET AS SLAVE ADCP
SM2
; ST0300       WAIT UP TO 300 SECONDS FOR SYNCHRONIZATION PULSE
ST0300
; TE01:00:00.00 PLAN DEFAULT SETUP SHOWN
TE01:00:00.00
; TP01:19.98   PLAN DEFAULT SETUP SHOWN
TP01:19.98
; WD111100000
WD111100000
; WP00045
WP00045          PLAN DEFAULT SETUP SHOWN
; WN030
WN030
; WS0400
WS0400
; WF0176
WF0176
; WV170
WV170
; EZ1111111
EZ1111111
; EA00000
EA00000
; EB00000
EB00000
; CF11101
CF11101
; CK
CK
$D3              WILL DELAY THE BBTALK PROGRAM 3 SECONDS BEFORE GOING TO NEXT COMMAND
; CS
CS
$L              WILL CLOSE THE FILE SV.TXT
$D3              WILL DELAY THE BBTALK PROGRAM 3 SECONDS BEFORE GOING TO NEXT COMMAND
$X              WILL EXIT FROM BBTALK

;Created as: SLAVE.CMD (1997/10/15 11:50:22.58  PLAN Version 1.30 )
;Deployment hours = 24.00
;Temperature     = 5.00
;Frequency       = 307200.00
```

Deployment

To deploy the Master and the Slave ADCP you must send the commands from the above files to each ADCP. The following method will ensure that each ADCP is starting at the same time and that each ensemble will be matched.



NOTE. This deployment sequence assumes that you have added all the commands specified in the examples above. If you have not added specifically the \$D3, \$L, and \$X command then the following routine will not work properly.

- a. Copy each of the modified files MASTER.CMD and SLAVE.CMD to files called MASTER.SCR and SLAVE.SCR respectively. Be sure that you copy the *.SCR files to the same directory as the *BBTALK* program.
- b. Connect the Master and Slave ADCPs cable and power.
- c. Connect the Slave ADCP to the Computer.
- d. Start the *BBTALK* program and wake-up the Slave ADCP. Pressing the **END** key on your keyboard does this.
- e. Set the time in the Slave ADCP by typing the TS command and pressing the **ENTER** key on your keyboard. Syntax: TSYYMMDDhhmmss (YY = year, MM = month, DD = day, hh = hour, mm = minute, ss = second).



CAUTION. The next 6 steps must be completed within 5 minutes or you will have to start from step c again. After step j do not send a break to either ADCP without starting over.

- f. Connect the Master ADCP to the Computer.
- g. Start the *BBTALK* program and wake-up the Master ADCP. Pressing the **END** key on your keyboard does this.
- h. Set the time in the Master ADCP by typing the TS command and pressing the **ENTER** key on your keyboard. Syntax: TSYYMMDDhhmmss (YY = year, MM = month, DD = day, hh = hour, mm = minute, ss = second).
- i. Exit *BBTALK*.
- j. Connect the Slave ADCP to the Computer. At the DOS prompt type the command line *BBTALK SLAVE.SCR*. The *BBTALK* program will automatically send all of the commands from the SLAVE.SCR file, record all transactions to a file titled SV.TXT, and exit back to the DOS prompt.
- k. Connect the Master ADCP to the Computer. At the DOS prompt type the command line *BBTALK MASTER.SCR*. The *BBTALK* program will automatically send all of the commands from the MASTER.SCR file, record all transactions to a file titled MR.TXT, and exit back to the DOS prompt.
- l. Disconnect the Master ADCP from the computer and place dummy plugs on the ends of the Master/Slave cable.

The deployment sequence is now complete and the ADCPs will be pinging. After reviewing the MR.txt and SV.txt files, you can deploy the ADCPs.

Z-3.2 Example 2 – Synchronizing an ADCP with Other Instruments

This example will show how to set the synchronize the ADCP with other instruments. This can be used to eliminate interference when two instruments are using the same frequency.

ADCP Command File

If the ADCP is to be setup as the Master (i.e. it generates the synchronization pulse), use the MASTER.CMD command file from example 1. If the ADCP is the slave unit, use the commands from the SLAVE.CMD file as shown in example 1.

Synchronization Pulse Timing

The Master/Slave function uses the RS-485 bus to communicate between the instruments. To send the 20-millisecond pulse the RS485B line transitions from High to Low and the RS485A line transitions from Low to High. They will remain in that state for 20 milliseconds, then transition back to the quiescent states. The voltage of both lines with respect to the Communication Ground is 0 to 5VDC.

Both the High and Low signals are fed into a differentiator, which looks for a difference between the two signals. If the difference is 5VDC, it outputs logic 1. If the difference is -5 VDC, it outputs logic 0. The RS485 A IN is the low line, and RS485 B IN is the high line. So a logic 1 coming out of a Workhorse would have RS485A IN = 0VDC, and RS485B IN = 5VDC, and a logic 0 would have RS485A IN = 5VDC, and RS485B IN = 0.

Table Z-3. Synchronization Timing

RS485A	RS485B	Logic	Result
Low (0 VDC)	High (5 VDC)	1	Default state
High (5 VDC)	Low (0 VDC)	0	The 20 ms pulse will trigger the ADCP if it is set as the slave. The ADCP uses the rising edge of the pulse as the trigger.



NOTE. The optimum timing for the pulse is 20 to 30 ms. If the pulse is between 40 to 100 ms, it will be ignored. A pulse over 100ms will provide unpredictable results.

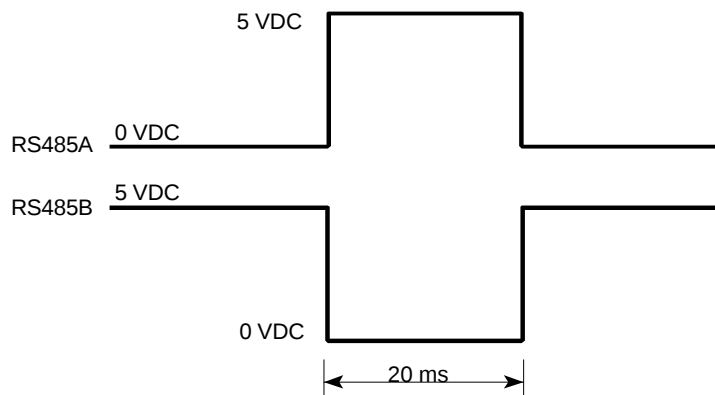


Figure Z-1. Synchronization Pulse Timing

Deployment

To deploy the ADCP you must send the commands to the ADCP. The following method will ensure that the ADCP is starting at the same time and that each ensemble will be matched.



NOTE. This deployment sequence assumes that you have added all the commands specified in the examples above. If you have not added specifically the \$D3, \$L, and \$X command then the following routine will not work properly.

- a. Copy each of the modified files MASTER.CMD and SLAVE.CMD to files called MASTER.SCR and SLAVE.SCR respectively. Be sure that you copy the *.SCR files to the same directory as the *BBTALK* program.
- b. Setup the ADCP using the Master Slave “X” cable and connect power to the ADCP.
- c. Connect the other instrument using the special pigtail cable.
- d. Connect the ADCP to the Computer.
- e. Start the *BBTALK* program and wake-up the ADCP. Pressing the  key on your keyboard does this.
- f. Set the time in the ADCP by typing the TS command and pressing the  key on your keyboard. Syntax: TSYMMDDhhmmss (YY = year, MM = month, DD = day, hh = hour, mm = minute, ss = second).



CAUTION. The next 2 steps must be completed within 5 minutes or you will have to start from step e again. After step i do not send a break to either ADCP without starting over.

- g. Exit *BBTALK*.
- h. Send the commands to the ADCP.
 1. **ADCP Set as the Slave Unit.** At the DOS prompt type the command line BBTALK SLAVE.SCR. The *BBTALK* program will automatically send all of the commands from the SLAVE.SCR file, record all transactions to a file titled SV.TXT, and exit back to the DOS prompt.
 2. **ADCP Set as the Master Unit.** At the DOS prompt type the command line BBTALK MASTER.SCR. The *BBTALK* program will automatically send all of the commands from the MASTER.SCR file, record all transactions to a file titled MR.TXT, and exit back to the DOS prompt.
- i. Disconnect the ADCP from the computer and place dummy plugs on the ends of the Master/Slave cable.

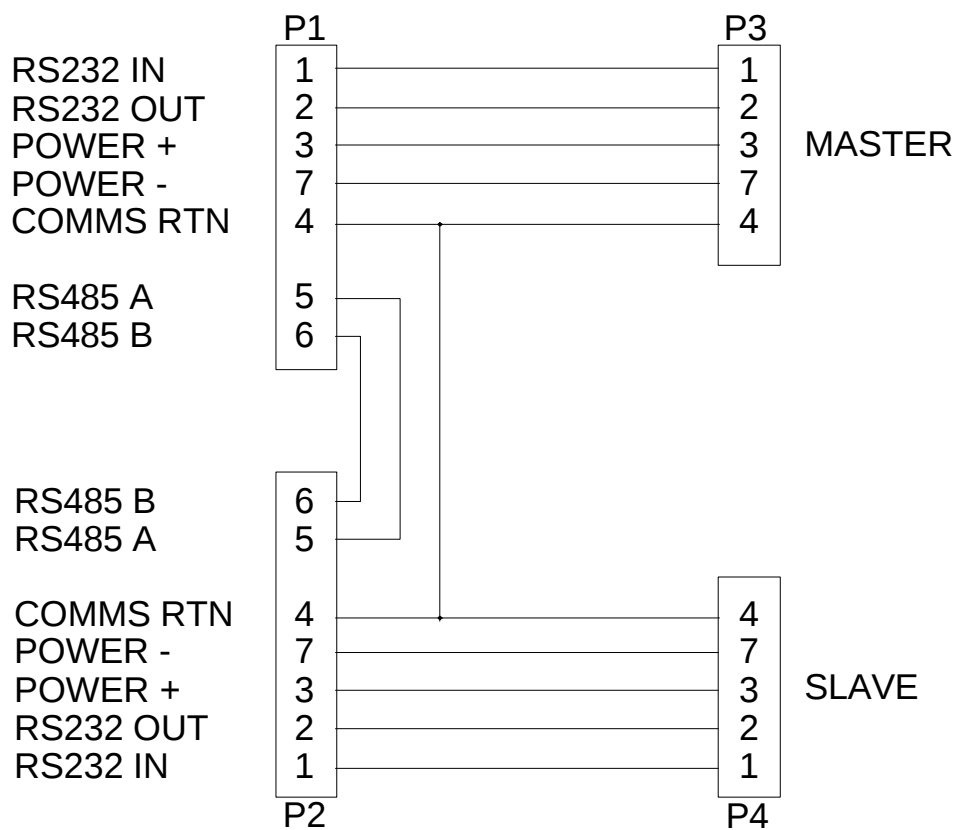
The deployment sequence is now complete and the ADCP will be pinging. After reviewing the MR.txt or SV.txt files, you can deploy the ADCP.

Z-4 Data Recovery

The *RECOVER* program can be used to recover data from the ADCP(s). If you used two ADCPs connected as Master/Slave, the order of which ADCP you download data from first does not matter. However, we recommend downloading the data from the Master ADCP first. Once the Master ADCP is stopped, the Slave ADCP will stop pinging. If the Slave ADCP did continue pinging, looking at the Master ADCP's data, you can determine the last valid ensemble to use for synchronization.

Z-5 Cables and Interconnections

Use the following figures to interconnect the ADCP's.



P1 & P2 = FEMALE WET CONNECTORS (LPMIL-7-FS)
P3 & P4 = MALE WET CONNECTORS (LPMIL-7-MS)

Figure Z-2. Master/Slave Cable Wiring

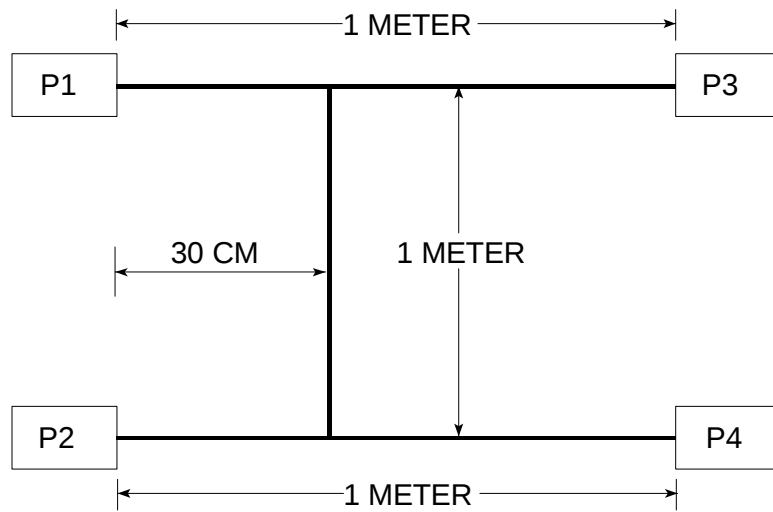


Figure Z-3. Master/Slave "X" Cable Length

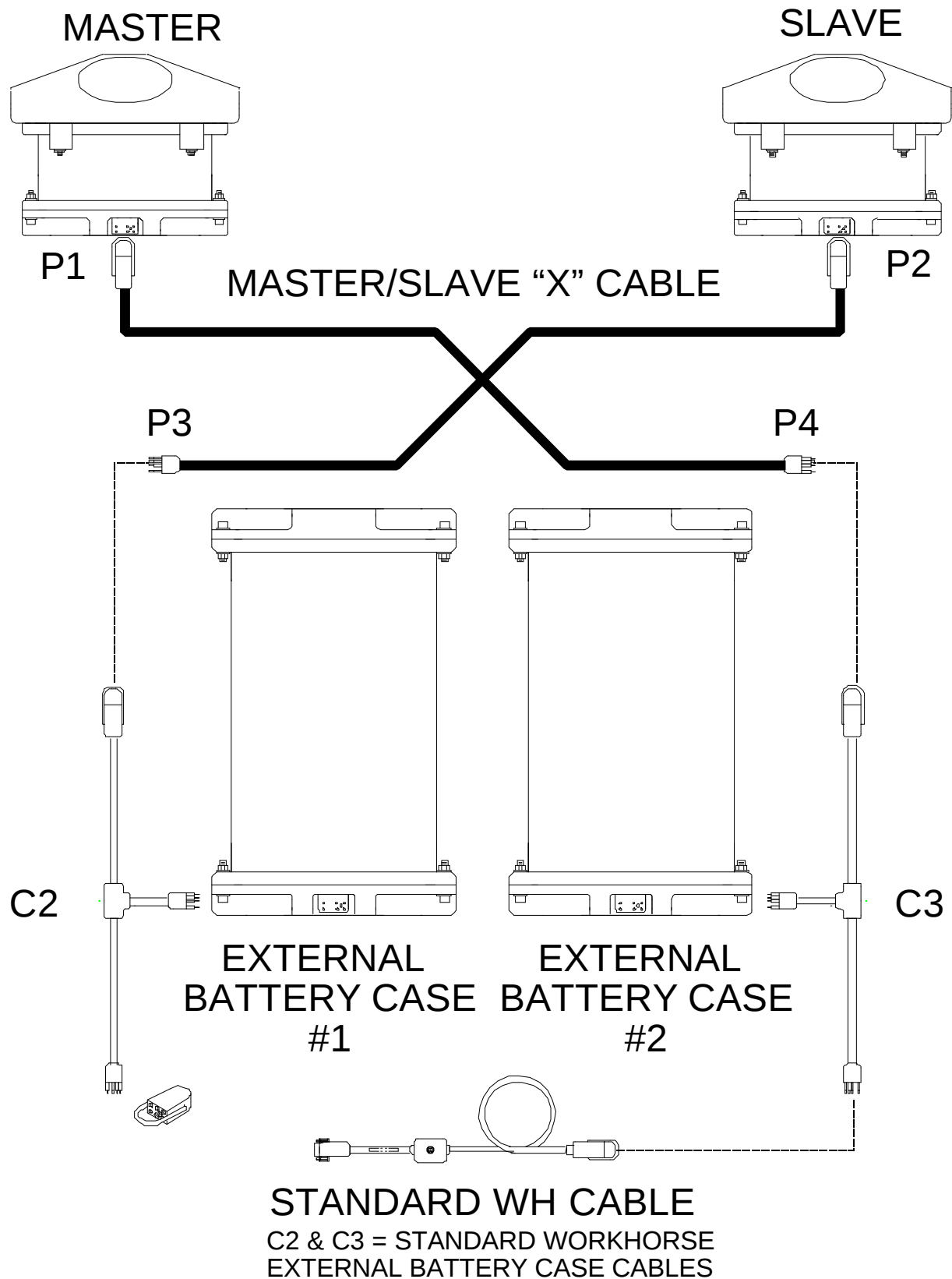
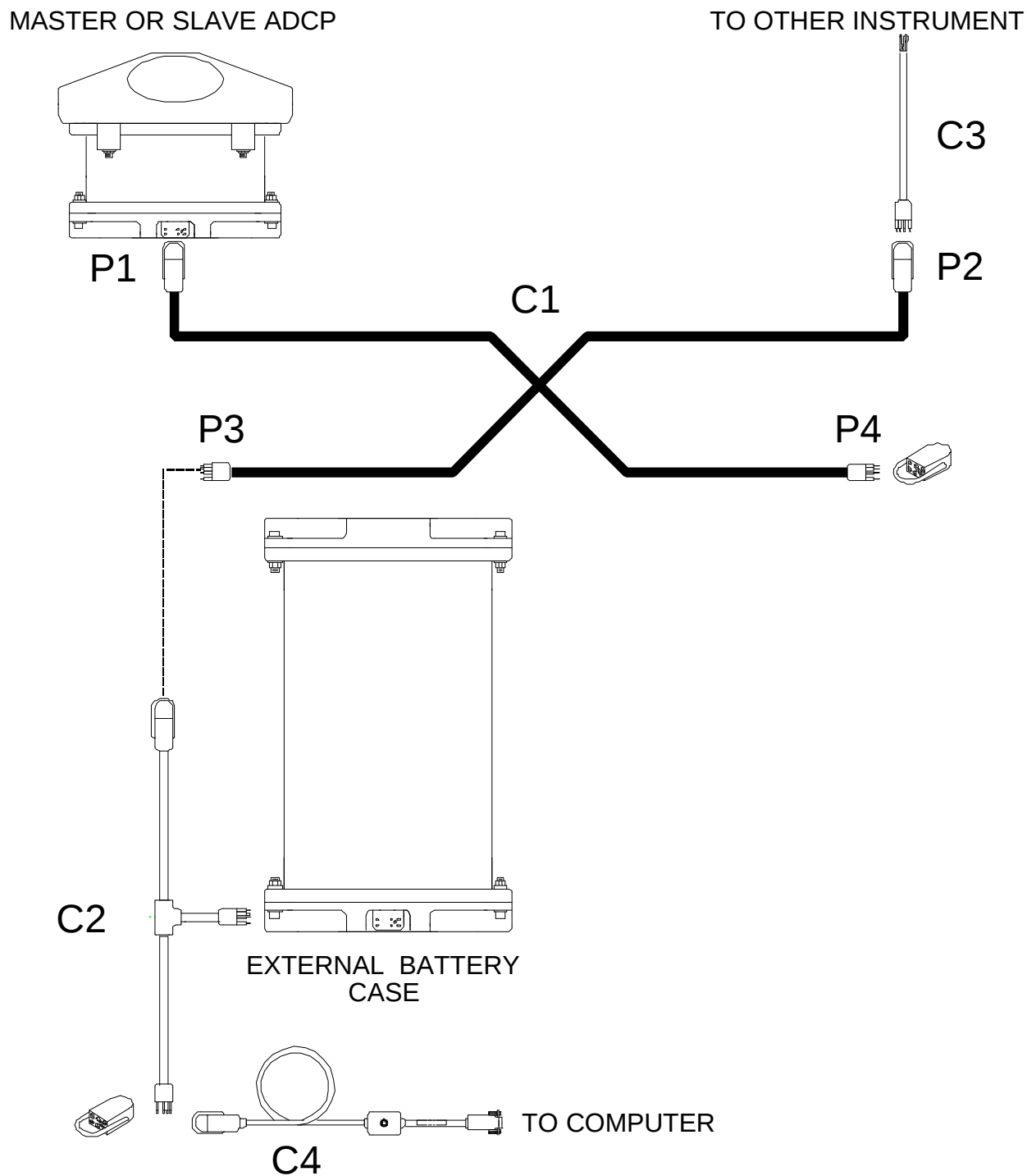


Figure Z-4. Master/Slave Cable Connections Using Two ADCPs



C1 = SPECIAL MASTER/SLAVE "X" CABLE
 C2 = STANDARD WORKHORSE EXTERNAL BATTERY CASE CABLES
 C3 = SPECIAL PIGTAIL CABLE
 C4 = STANDARD WORKHORSE I/O CABLE

Figure Z-5. Master/Slave Interconnections with Other Instruments

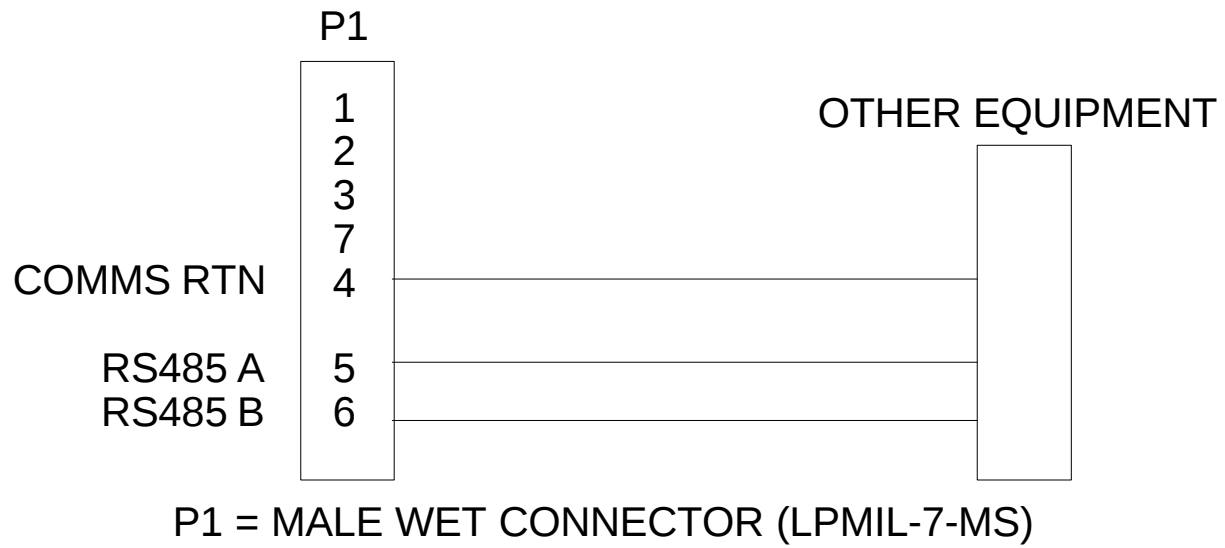


Figure Z-6. Special Pigtail Cable