

Lowered ADCP

1 Introduction

A standard Workhorse ADCP with version 8.19 firmware and higher with the Lowered ADCP feature installed has the capability to be setup as a Lowered ADCP (LADCP) instrument. The LADCP uses two Workhorse ADCPs mounted on a rosette. The rosette is lowered through the water column (one ADCP is looking up and the other is looking down). This setup allows you to cover a larger part of the water column. By lowering the ADCPs through the water column you can get an ocean profile that is greater in range than the two systems combined. In a setup like this, you would want both ADCPs to collect data at the same time or synchronize their pinging.

To synchronize the instruments you must use the Master/Slave feature. The ADCP Master/Slave feature is turned on via the S-commands. Although either system can be made into the Master or the Slave, RDI recommends that the downward facing system be the Master and the upward facing system to be the Slave. This will ensure that the timing of each system is always the same.

The LADCP setup is independent of the Master/Slave feature. Using the L-commands in place of the equivalent W-commands turns on the LADCP feature. The LADCP feature allows the ADCP to collect both water profile data and when in range collect bottom track data. A separate bottom track ping is not required. This means that there is no time (or pings) spent trying to collect bottom track data. The LADCP automatically detects the bottom when it is within approximately 150 meters of the bottom. The LADCP feature uses a limited version of bottom track. It is designed to measure the vertical motion of the ADCP and is not intended to track the ADCP's motion over the bottom. You do not have to have the bottom track upgrade installed to use the LADCP feature.

The following sections describe how to setup your ADCPs for a LADCP deployment using both of these features.

2 Requirements

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

- Two Workhorse ADCPs that have firmware version 8.19 or higher
- The Lowered ADCP Feature Upgrade must be installed on both ADCPs used.
- Special Master/Slave Cable that allows each ADCP to talk to each other
- Both Workhorse ADCPs must be setup in RS232 Mode
- Internal batteries (Sentinel) or External battery packs
- WinSC Software Program
- RDI Tools Software Program



NOTE. The example shown uses firmware version 8.23 or later (Workhorse). Some commands changed or were added since firmware versions 8.19 through 8.22.

For instructions on how to update the firmware and install the LADCP feature upgrade, see the Feature Upgrade Setup Card.

3 Example

The following LADCP example shows the basic steps used to configure two Workhorse ADCPs. Since LADCPs must collect the same data simultaneously we will use the same setup for each ADCP and the master/slave setup will cause the ADCPs to ping simultaneously.

3.1 Basic Setup

The basic commands for the Master and Slave ADCP setups are no different from a “standard” deployment. You should use WinSC’s *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 a LADCP type of deployment:

- 20 bins
- 10 meter bins
- 1 ping per ensemble



- 2 seconds between ensembles (note this is the minimum setting that the WinSC's *PLAN* program allows)
- 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

Figure 1. Plan Setup Screen

Once you have created the basic configuration file click **Finish** and save the file as Master.txt. Copy the Master.Txt and rename the file SLAVE.txt.

3.2 Master Setup

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



NOTE. RDI recommends that the downward facing ADCP be the Master.

Add the following commands to the MASTER.txt file. Remember that this example is assuming a LADCP deployment. 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 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 (this is required when using single ping ensembles)
SW75	Sets the number of millisecs 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
LW1	Sets the Workhorse ADCP into a narrow bandwidth and extends the profiling range by 10%
\$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.



Change the following commands in the MASTER.txt file. Remember that this example is assuming an LADCP deployment. Be sure to change the command in both the lines following the semi-colon and the line with the command by itself.

Table 2: Master Command File Edited Commands

Command	Description
TP	Change the TP command from TP00:01.50 to TP00:01.00 {1 seconds between pings}
TE	Change the TE command from TE00:00:02.00 to TE00:00:01.00 {1 seconds per ensemble}
LD	Change the WD command from WD111100000 to LD111100000
LF	Change the WF command from WF0176 to LF0176
LP	Change the WP command from WP00001 to LP00001
LN	Change the WN command from WN020 to LN020
LS	Change the WS command from WS1000 to LS1000
LV	Change the WV command from WV170 to LV170
EZ	Change the EZ command from EZ1111111 to EZ0111111; turns off the speed of sound Correction and uses the factory default fixed speed of sound of 1500m/sec

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          TRANSMITS SYNCHRONIZING PULSE BEFORE EACH WATER PING
SA001
; SI0            SYNCHRONIZING PULSE SENT ON EVERY PING
SI0
; SW75           WAIT 75 MILLISECONDS
SW75
; TE00:00:01.00  CHANGED FROM TE00:00:02.00
TE00:00:01.00
; TP00:01.00     CHANGED FROM TP00:01.50
TP00:01.00
; LD111100000    CHANGED FROM WD111100000
LD111100000
; LP00001        CHANGED FROM WP00001
LP00001
; LN020          CHANGED FROM WN020
LN020
; LS1000         CHANGED FROM WS1000
LS1000
; LF0176         CHANGED FROM WF0176
LF0176
; LV170          CHANGED FROM WV170
LV170
; LW1            ADDED LW1 command
LW1
; EZ0111111     CHANGED FROM EZ1111111
EZ0111111
; 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.txt (2001/02/15 10:50:22.58  PLAN Version 1.30 )
;Deployment hours = 24.00
;Temperature     = 5.00
;Frequency       = 307200.00
```



3.3 Slave Setup

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



NOTE. RDI recommends that the upward facing ADCP be the Slave.

Add the following commands to the SLAVE.txt file. Remember that this example is assuming an LADCP deployment. 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 3: 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. Since this example is a LADCP setup, then both Workhorse ADCPs must ping together (however, if there is a problem the slave will still ping once every 300 seconds)
LW1	Sets the Workhorse ADCP into a narrow bandwidth and extends the profiling range by 10%
\$LSV.TXT	Used by BBTalk 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 BBTalk to delay for 3 seconds before continuing to the next command. Required during the deployment sequence using BBTalk. Do not include if you intend to use another RDI supplied deployment software package.
\$X	Used by BBTalk to exit from BBTalk program. Do not include if you intend to use another RDI supplied deployment software package.

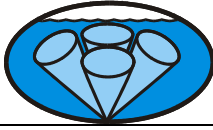
Change the following commands in the SLAVE.txt file. Remember that this example is assuming an LADCP deployment that wants to allow for simultaneous pings. Be sure change the command in both the lines following the semi-colon and the line with the command by itself.

Table 4: Slave Command File Edited Commands

Command	Description
TP	Change the TP command from TP00:01.50 to TP00:00.00 {0 seconds between pings}
TE	Change the TE command from TE00:00:02.00 to TE00:00:00.00 {0 seconds between ensembles, ping time is being controlled by the Master}
LD	Change the WD command from WD111100000 to LD111100000
LF	Change the WF command from WF0176 to LF0176
LP	Change the WP command from WP00001 to LP00001
LN	Change the WN command from WN020 to LN020
LS	Change the WS command from WS1000 to LS1000
LV	Change the WV command from WV170 to LV170
EZ	Change the EZ command from EZ1111111 to EZ0111111; turns off the speed of sound correction and uses the factory default fixed speed of sound of 1500m/sec

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
; SA001          LISTENS FOR SYNCHRONIZING PULSE BEFORE EACH PING
SA001
; ST0300         WAIT UP TO 300 SECONDS FOR SYNCHRONIZATION PULSE
ST0300
; TE00:00:00.00  CHANGED FROM TE00:00:02.00
TE00:00:00.00
; TP00:00.00     CHANGED FROM TP00:01.50
TP00:00.00
; LD111100000    CHANGED FROM WD111100000
LD111100000
; LP00001        CHANGED FROM WP00001
LP00001
; LN020          CHANGED FROM WN030
LN020
; LS1000         CHANGED FROM WS1000
LS1000
; LF0176         CHANGED FROM WF0176
```



```
LF0176
; LV170          CHANGED FROM WV170
LV170
; LW1           ADDED LW1 command
LW1
; EZ01111111    CHANGED FROM EZ1111111
EZ0111111
; EA00000       EA00000
EA00000
; EB00000       EB00000
EB00000
; CF11101       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.txt (2002/10/15 11:50:22.58  PLAN Version 1.30 )
;Deployment hours = 24.00
;Temperature     = 5.00
;Frequency       = 307200.00
```

3.4 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.

- Connect the Master and Slave ADCPs cable and power.
- Connect the Slave ADCP to the Computer.
- Start the *BBTalk* program and press the **End** key on your keyboard to wake-up the Slave ADCP.



NOTE. For more information on how to use *BBTalk*, see the RDI Tools User's Guide. The new Windows version of *BBTalk* has replaced *DumbTerm* and the DOS version of *BBTALK*.

- 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 b again. After step h do not send a break to either ADCP without starting over.

- e. Connect the Master ADCP to the Computer.
- f. Start the *BBTalk* program and press the **End** key on your keyboard to wake-up the Master ADCP.
- g. 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).
- h. Connect the Slave ADCP to the Computer. In *BBTalk*, press **F2** to run a script file. Select the `SLAVE.txt` file. The *BBTalk* program will automatically send all of the commands from the `SLAVE.txt` file, record all transactions to a file titled `SV.txt`.
- i. Connect the Master ADCP to the Computer. In *BBTalk*, press **F2** to run a script file. Select the `MASTER.txt` file. The *BBTalk* program will automatically send all of the commands from the `MASTER.txt` file, record all transactions to a file titled `MR.txt`.
- j. Disconnect the Master ADCP from the computer and place dummy plugs on the ends of the Master/Slave cable.

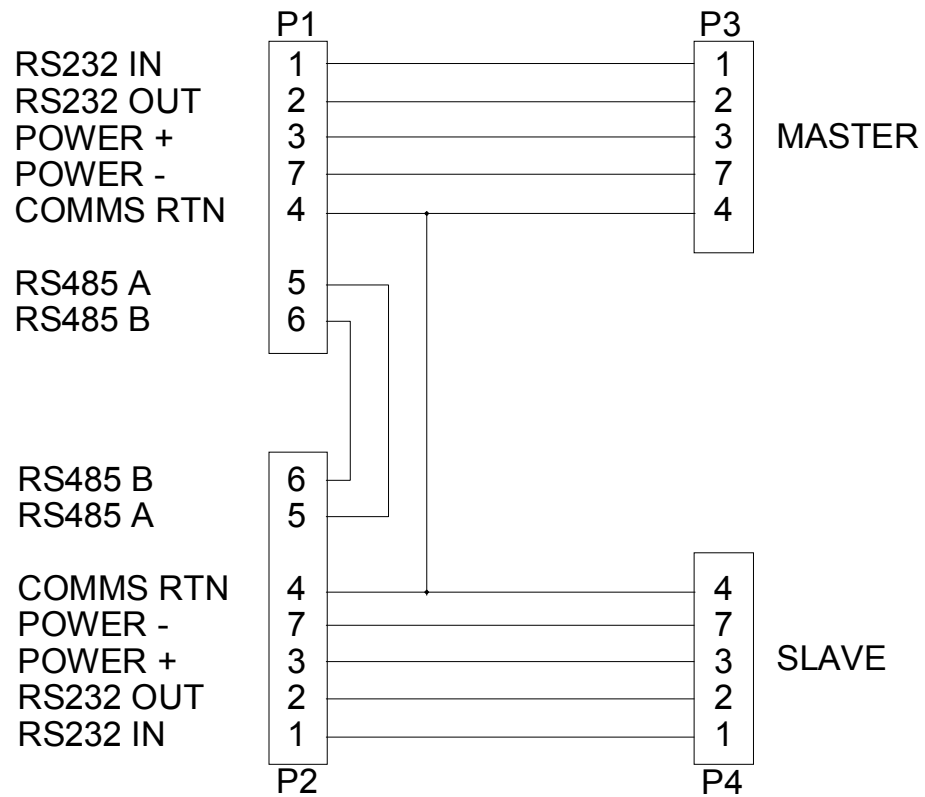
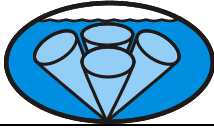
The deployment sequence is now complete and the ADCPs will be pinging. After reviewing the `MR.txt` and `SV.txt` files, you can deploy the ADCPs.

3.5 Recovery

The *WinSC* or *RDI Tools* programs can be used to recover data from each ADCP. 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.

4 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 2. Master/Slave Cable Wiring

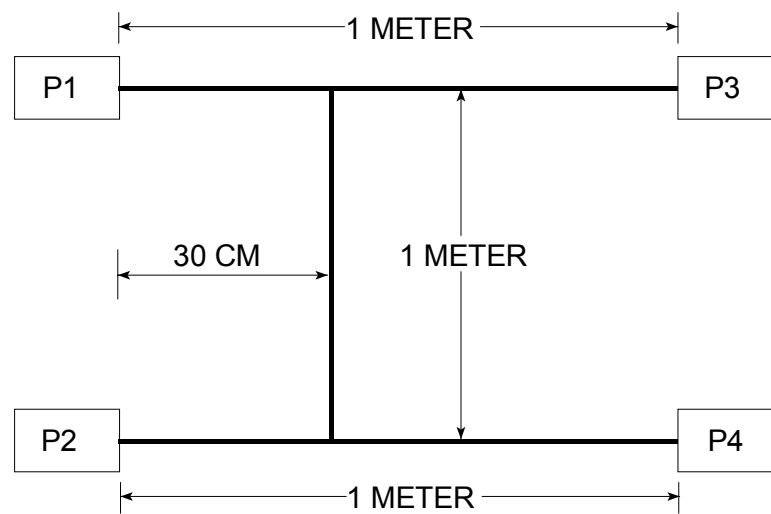


Figure 3. Master/Slave Cable Length

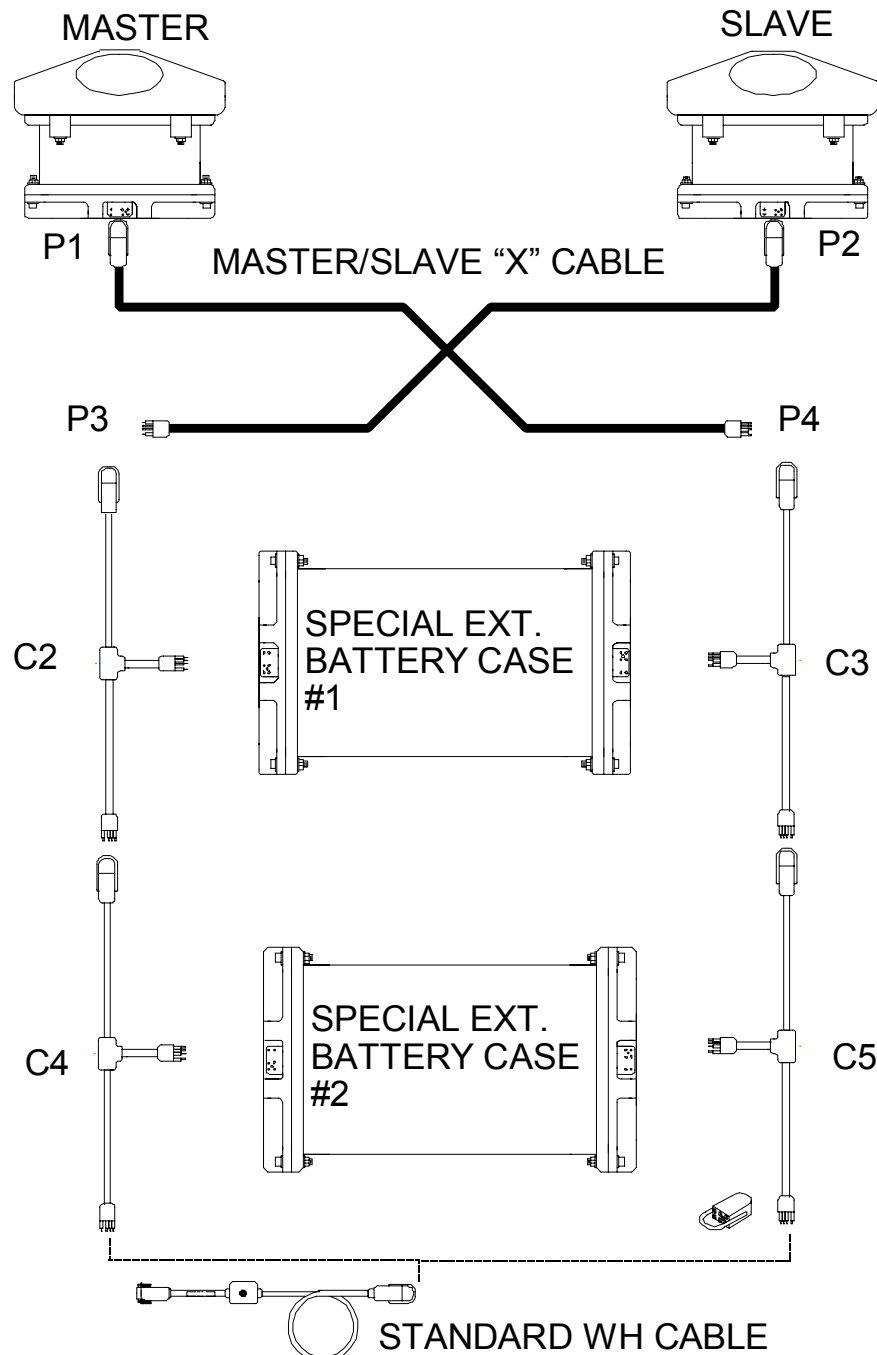


Figure 4. Lowered ADCP Interconnections

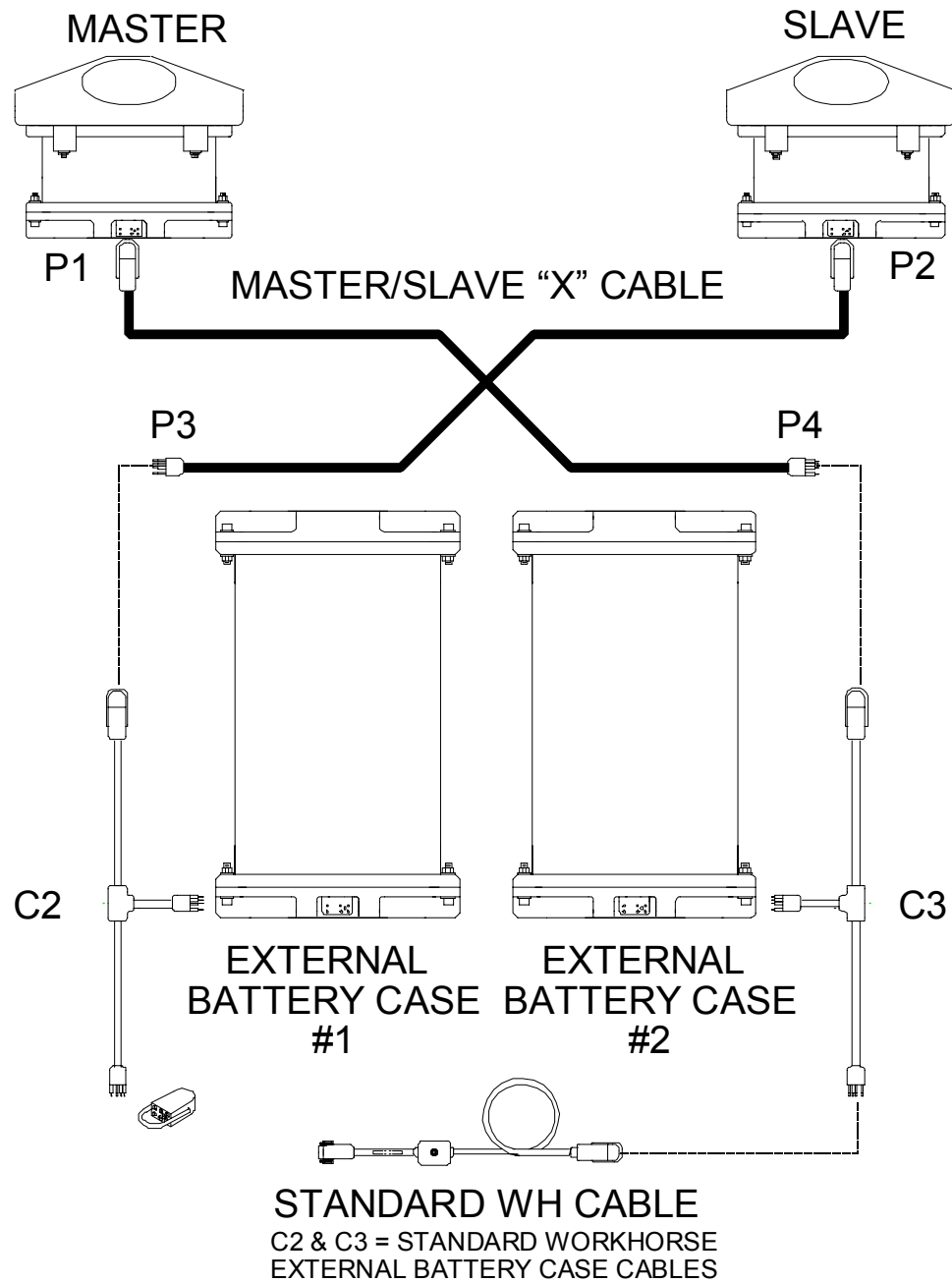


Figure 5. Master/Slave Cable Connections Using Standard External Battery Cases