LOWERED ADCP

USER'S GUIDE

TELEDYNE MARINE
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HOW TO CONTACT TELEDYNE RD INSTRUMENTS

If you have technical issues or questions involving a specific application or deployment with your instrument, contact our Field Service group:

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For all your customer service needs including our emergency 24/7 technical support, call +1 (858) 842-2700

Self-Service Customer Portal

Use our online customer portal at http://www.teledynemarine.com/rdi and click on the **Support** link to download manuals or other Teledyne RDI documentation.

Teledyne Marine Software Portal

Teledyne RD Instruments Firmware, software, and Field Service Bulletins can be accessed only via our Teledyne Marine software portal.

To register, please go to https://tm-portal.force.com/TMsoftwareportal to set up your customer support account. After your account is approved, you will receive an e-mail with a link to set up your log in credentials to access the portal (this can take up to 24 hours).

Once you have secured an account, use the Teledyne Marine software portal to access this data with your unique username and password.

If you have an urgent need, please call our Technical Support hotline at +1-858-842-2700.

CONVENTIONS USED IN THIS MANUAL

Conventions used in the LADCP User's Guide have been established to help learn how to use the system quickly and easily.

Menu items are printed in bold: click **Collect Data**. Items that need to be typed by the user or keys to press will be shown as **<F1>**. If a key combination were joined with a plus sign **(<ALT+F>)**, press and hold the first key while pressing the second key. Words printed in italics include program names (*TRDI Toolz*) and file names (*TestWH.rds*).

Code or sample files are printed using a fixed font. Here is an example:

```
[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2012
All Rights Reserved.
>
```

There are two visual aids to help: Notes and Cautions.

This paragraph format indicates additional information that may help you avoid problems or that should be considered in using the described features.

This paragraph format warns the reader of hazardous procedures (for example, activities that may cause loss of data or damage to the WorkHorse ADCP).

REVISION HISTORY

August 2021

- Updated the Contacting TRDI table
- Added link to PD0Decoder
- Replaced *BBTalk* with *TRDI Toolz*

April 2013

- Added cable 730-6057.
- Added corrections from ICN118 (SB Command and LADCP Deployments).
- Updated styles and fonts.

August 2008

- Updated script files and instructions to use WM15 (firmware version 16.30 or higher).

Jan2007

- Initial release.

EXCLUSIONS AND OMISSIONS

1: None

NOTES

EAR-Controlled Technology Subject to Restrictions Contained on the Cover Page.

Introduction

A Teledyne RD Instruments (TRDI) standard Workhorse ADCP with version 16.30 firmware and higher with Water Mode 15 (WM15) installed has the capability to be set up as a Lowered ADCP (LADCP) instrument. The LADCP / WM15 uses one or 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 a larger coverage of the water column. By lowering the ADCPs through the water column you can obtain an ocean profile that is greater in range than the systems combined. In a setup like this, the ADCPs can collect data at the same time or synchronize their pinging when using two ADCPs.

Figure 1.　　　　**WorkHorse Monitors Mounted on a Rosette**

Pictures courtesy of NIOZ

Figure 2.　　　　**LADCP Rosette**

Lowered ADCP Setup Using Two ADCPs

The following sections describe how to set up the ADCPs for a WM15 deployment using both the WM15 and the Master/Slave features. If you are using the WM15 feature with <u>one</u> ADCP, see <u>Creating WM15 Command Files for One ADCP</u>.

When using two ADCPs for WM15 work, there are two ways to set up the systems:

1. The first is to synchronize both ADCPs so that they transmit and receive at the same time.

2. The second is to have the two systems synchronize such that only one transmits and receives, and then the other ADCP transmits and receives.

The benefit of having the two systems pinging at the same time is that it makes combining the two instruments profiles into a single profile easier.

The benefit of the second method is that it prevents signals that are reflected off of the surface or bottom from interfering with the opposite system.

Teledyne RD Instruments does not have enough experience to recommend one method over the other. However, initial responses from users suggest that setting the system up with the second method offers more benefits than the first method. Both methods are documented and we suggest you try both to decide.

To synchronize the instruments, 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, TRDI 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 WM15 setup is independent of the Master/Slave feature. Users must install the WM15 mode and send the WM15 command for ADCPs with firmware version 16.30 and above to enable the LADCP feature. The WM15 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 WM15 automatically detects the bottom when it is within approximately 150 meters of the bottom. The WM15 feature uses a limited version of bottom track. It is designed to measure the horizontal and vertical motion of the ADCP near the bottom and is not intended to track the ADCP's motion over the entire water column. The bottom track upgrade is not required to be installed to use the WM15 feature.

Requirements

The following is a list of the minimum requirements when using the WM15 and Master/Slave Workhorse setup:

*   ADCPs with version 16.30 firmware or higher and must have the Water Mode 15 Feature Upgrade installed on both ADCPs

*   Special Star Cable (see Figure 7) that allows each ADCP to talk to each other

*   Both Workhorse ADCPs must be set up in RS232 Mode and using 9600 Baud

*   Internal batteries (Sentinel) or External battery packs

*   *WinSC* and *TRDI Toolz* Software Programs

Using WM15 (see the WM command in the WorkHorse Commands and Output Data Format guide) turns on the LADCP feature and the 'W' commands can be used to set parameters. The 'L' menu has been left in place to minimize changes to customer script files.

> If the WM15 command is not sent to the ADCP, the L commands are disabled.

The Lowered ADCP output data format will show up as Water-Profiling Mode 15 and Bottom-Track Mode 11 PD0 data. Bottom-Track Mode 5 will be ignored if the Lowered ADCP feature is used.

Installing the WM15 Feature Upgrade

The feature upgrade installation program is used to install the Lowered ADCP (WM15) capabilities in a Workhorse ADCP.

> The upgrade disk is specific to the unit for which it was ordered. DO NOT attempt to install this feature for any other unit.

> Many feature upgrades require the latest firmware version to be installed in the ADCP. If the firmware needs to be updated, do this before installing the feature upgrade.

To install a firmware update:

3. Setup the communication parameters between *TRDI Toolz* and the ADCP.

4. Wake up the ADCP by pressing the ⚡ button.

5. Click **Tools**, **Activate Features**.

6. Select the **.Feature* update file.

7. Use the OL command to verify the feature upgrade has been installed.

Removing the WM15 Feature Upgrade

The WM15 Lowered ADCP feature does not need to be removed in order to use the water profiling commands. When the ADCPs receive the WM15 command, the ADCP automatically changes several commands to LADCP appropriate values. It changes the water profile bandwidth to 6.25% by setting WB and LW to 1, the number of water profile pings to 1 by setting WP and LP to 1, and the time per ensemble and time per ping to 1 second by setting TE 00:00:01.00 and TP 00:01.00 respectively.

Conversely, when the ADCP has been using WM15 and receives the WM1 command, the ADCP automatically changes the same command parameters to their factory default values.

Master/Slave WM15 Command Files

The Marine Measurement CD provides three example command files. The command file *Master1.txt* will have both the Master ADCP and the Slave ADCP ping at the exact same moment. The command file *Master2.txt* will have the Master ADCP ping 0.5 seconds after the Slave ADCP. The command file *Slave.txt* controls the Slave ADCP for both of the Master Command files. If you would like to create your own command files then see Creating Master/Slave WM15 Command Files for Two ADCPs.

Deployment

To deploy the Master and the Slave ADCP, 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.

> ⚠️ Both ADCPs must be using 9600 Baud in order to ping at the same time.

> 📌 This deployment sequence assumes that you are using the files specified above or similar ones created by yourself. If you have not added specifically the $D3, $L, $W62, and $X commands, then the following procedure will not work properly.

Using a Computer with Two COM Ports (Recommended)

To connect to the ADCPs:

1. Connect the Master and Slave ADCPs using the Star cable and the external battery pack/power source (see Figure 9).

> ⚠️ To avoid having "hot pins" TRDI recommends disconnecting P3 **before** connecting P4 or P5.
>
> Note that there is no diode protection at the P3 connector. Power applied at P4 or P5 will send DC Volts on the pins of P3. This was done on purpose as customers may want to "recharge" the external battery packs while powering the ADCPs to download the data.

> 📌 At this point, the ADCPs should be mounted as they will be deployed and powered using the power source they will use during the deployment. Power must not be interrupted once the commands are sent to the ADCP.

2. Start the *TRDI Toolz* program and wake up the Master ADCP by pressing the ⚡ button.

3. Click **New Connection**. Set up communications with the Slave ADCP. Once you have communications set up for both ADCPs, you can switch between them by clicking on the tab (see Figure 3).
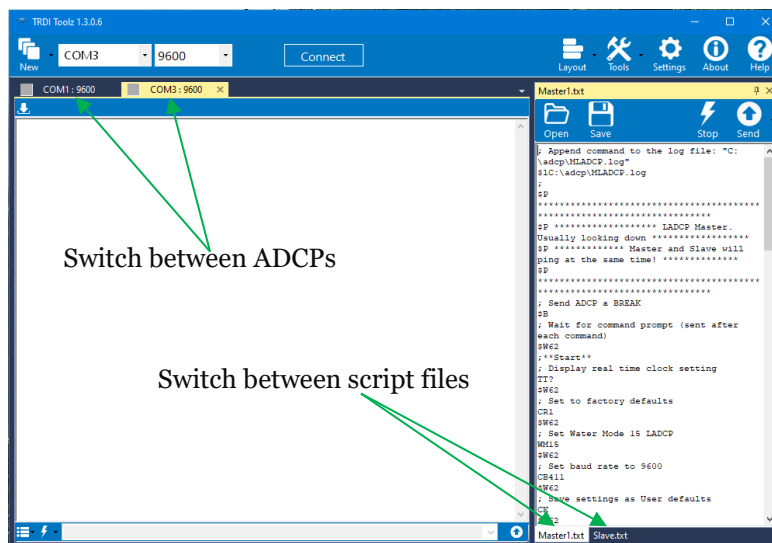
Figure 3.   TRDI Toolz Display with Two Communication Tabs and Two Script Files

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4. Open the script editor by clicking **Tools**, **Script Editor**. Click the drop-down menu to ensure to **Send to current** is checked.

Click the **Open** icon. Open the *Slave.txt* file and then click **Open** again and select the *Master1.txt* or *Master2.txt* file. You can easily switch between the script files by clicking on the tabs at the bottom of the script editor (see Figure 3)
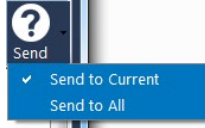
5. Click on the Slave ADCP communication window Verify the Slave ADCP clock by clicking **Tools**, **PC Time to ADCP**.

> ⚠️ The next seven steps must be completed within 5 minutes or you will have to start from step 2 again. After step 6 do not send a break to either ADCP without starting over.

6. Click on the Master ADCP communication window and press the 🗲 button to wake-up the Master ADCP.

7. Verify the Master ADCP clock setting by clicking **Tools**, **PC Time to ADCP**.

8. Click on the Slave ADCP communication window. Select the *Slave.txt* file on the Script Editor.

9. Click the **Send** icon. The *TRDI Toolz* program will automatically send all the commands from the *Slave.txt* file and record all transactions to a file titled *C:\adcp\SLADCP.log*.

10. Click on the Master ADCP communication window. Select the *Master1.txt* or *Master2.txt* file on the Script Editor.

11. Click the **Send** icon. The *TRDI Toolz* program will automatically send all the commands from the *Master1.txt* or *Master2.txt* file and record all transactions to a file titled *C:\adcp\MLADCP.log*.

12. Disconnect the ADCPs from the computer and place dummy plugs on the ends of the star cable.

The deployment sequence is now complete and the ADCPs will be pinging. After reviewing the log files, you can start the WM15 cast.

# Using a Computer with One COM Port

To connect to the ADCPs:

1. Connect the Master and Slave ADCPs using the Star cable and the external battery pack/power source (see Figure 9).

> ⚠️ To avoid having "hot pins" TRDI recommends disconnecting P3 **before** connecting P4 or P5.
>
> Note that there is no diode protection at the P3 connector. Power applied at P4 or P5 will send DC Volts on the pins of P3. This was done on purpose as customers may want to "recharge" the external battery packs while powering the ADCPs to download the data.

> 📌 At this point, the ADCPs should be mounted as they will be deployed and powered using the power source they will use during the deployment. Power must not be interrupted once the commands are sent to the ADCP.

2. Connect the Slave ADCP to the Computer.

3. Start the *TRDI Toolz* program and wake up the Slave ADCP by pressing the 🗲 button.

4. Open the script editor by clicking **Tools**, **Script Editor**. Click the **Open** icon. Open the *Slave.txt* file and then click **Open** again and select the *Master1.txt* or *Master2.txt* file. You can easily switch between the script files by clicking on the tabs at the bottom of the script editor (see Figure 3).

5. Verify the Slave ADCP clock by clicking **Tools**, **PC Time to ADCP.**

> ⚠️ The next six steps must be completed within 5 minutes or you will have to start from step 2 again. After step 6 do not send a break to either ADCP without starting over.

6. Connect the Master ADCP to the Computer.

7. Press the 🗲▾ button to wake-up the Master ADCP.

8. Verify the Master ADCP clock by clicking **Tools**, **PC Time to ADCP**.

9. Connect the Slave ADCP to the Computer. Select the *Slave.txt* file on the Script Editor. Click the **Send** icon. The *TRDI Toolz* program will automatically send all the commands from the *Slave.txt* file and record all transactions to a file titled *C:\adcp\SLADCP.log*.

10. Connect the Master ADCP to the Computer. Select the *Master1.txt* or *Master2.txt* file on the Script Editor. Click the **Send** icon. The *TRDI Toolz* program will automatically send all of the commands from the *Master1.txt* or *Master2.txt* file and record all transactions to a file titled *C:\adcp\MLADCP.log*.

11. 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 log files, you can deploy the ADCPs.

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WM15 Deployment with One ADCP

The following sections describe how to set up a single ADCP for a WM15 deployment.

WM15 Command File

On the Marine Measurement CD, we have provided the *LADCP.txt* command file for your use. To create your own command files, then see Creating WM15 Command Files for One ADCP.

Deployment Sequence

To deploy the ADCP, send the commands from the *LADCP.txt* command file to the ADCP.

> This deployment sequence assumes that you are using the file specified above or a similar one created by yourself. If the $D3, $L, $W62, and $X commands are not specifically added, then the following routine will not work properly.

To deploy the ADCP:

1. Connect the ADCP cable and the external battery pack/power source.

    > At this point, the ADCP should be mounted as it will be deployed and powered using the power source it will use during the deployment. Power must not be interrupted once the commands are sent to the ADCP.

2. Connect the ADCP to the Computer.

3. Start the *TRDI Toolz* program and press the ⚡ button to wake-up the ADCP.

4. Set the time in the ADCP by clicking **Tools**, **PC Time to ADCP**.

5. Open the script editor by click **Tools**, **Script Editor**.

6. Click the **Open** icon. Select the *LADCP.txt* file. The *TRDI Toolz* program will automatically send all the commands from the file and record all transactions to a file titled *C:\adcp\LADCP.log*.

7. Disconnect the ADCP from the computer and place a dummy plug on the end-cap or cable (as needed).

The deployment sequence is now complete and the ADCP will be pinging. After reviewing the log file, you can deploy the ADCP.

Data Recovery

The *WinSC* or *TRDI Toolz* programs can be used to recover data from each ADCP. The order of which ADCP data is downloaded from first does not matter. However, TRDI recommends stopping the Master ADCP from pinging first. Once the Master ADCP is stopped, the Slave ADCP will stop pinging. If the Slave ADCP does continue pinging, looking at the Master ADCP's data will determine the last valid ensemble to use for synchronization.

If the deployment used only one ADCP, then data recovery is no different than for a "standard" deployment.
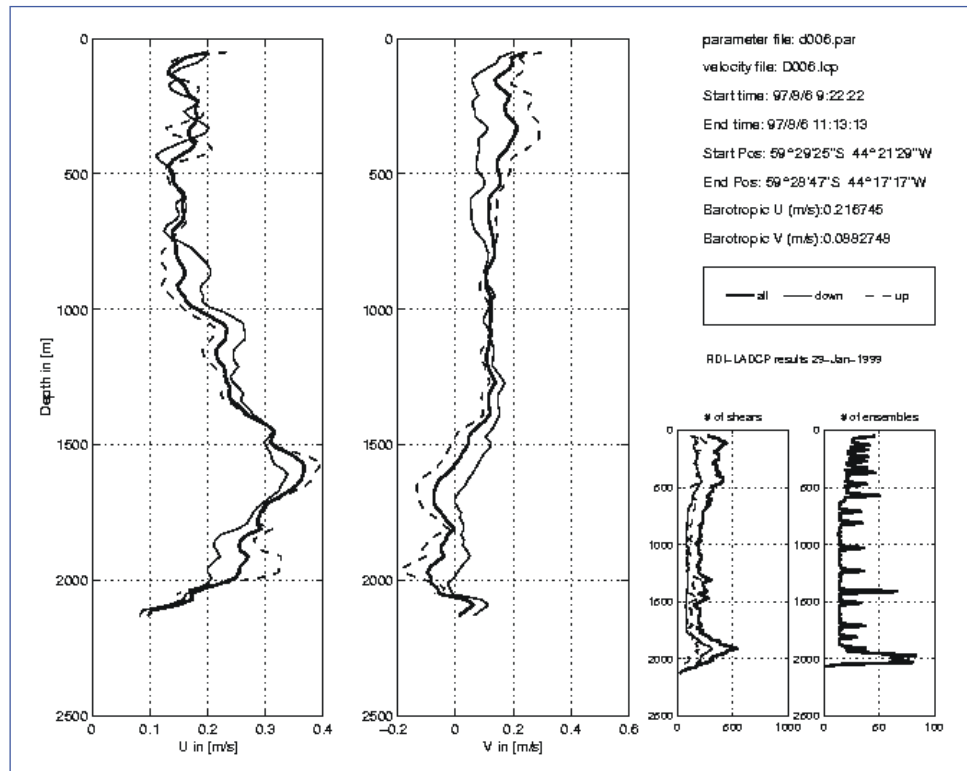
Figure 4.   **Sample Data Plot**

Plot courtesy of Lamont-Doherty.

PDDecoder Library in C language

The Teledyne Marine PDDecoder library is an open source library written in C language to decode the PD0 data formats that are commonly output by Teledyne Marine/Teledyne RD Instruments ADCPs. The definition and details of the PD0 format can be found in the Workhorse Commands and Output Data Format guide.

Available for download from the Teledyne Marine GitHub site at:

https://github.com/Teledyne-Marine/PDDecoder

WM15 Time Calculator

Included on the Marine Measurement CD is a Microsoft Excel® spreadsheet to help determine the time required for a WM15 deployment.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	LADCP Profiling Operation Time Calculator							Notes:	Enter your values in the green areas.				
2	Depth of cast	4000	meters						Red areas are calculations for you.				
3	Lowering rate	1	m/sec										
4	Number of casts per day	6											
5	Operation time per day	48000	secs/day	[includes round trip time]									
6	Total cruise days	15	days										
7	Total operation time	200	hours										
8	Total number of days	8.3	days	Enter this value in SC Application to calculate the total watt hours required.									
9													
10													
11	LADCP Data Download Time Calculator												
12	Total Number of Bytes in File	5.46	Mbytes	This is the total number of bytes required to complete a single LADCP cast!									
13	Download Speed	9600	baud rate										
14	Total time to download	95	minutes										
15	Total power to download (estimate)	0.3	watt hours										
16	Total number of downloads per day	6											
17	Total cruise days	15	days										
18	Total watt hour required for cruise	28.4	watt hours	If using internal batteries to download data then add this value to the SC Application watt hours									
19				calculated from using the above LADCP Operation Time Calculator and you will have the total									
20				watt hours required to both deploy and recover data.									
21													

Figure 5.   WM15 Time Calculator

Creating Master/Slave WM15 Command Files for Two ADCPs

The following WM15 example shows the basic steps used to configure two Workhorse ADCPs. Since WM15 collects the same data simultaneously, use the same setup for each ADCP and the master/slave setup will cause the ADCPs to ping simultaneously.

Using the WM15 Command

PlanADCP will only program ADCPs with versions 16.28 firmware with the Lowered ADCP feature installed.

Instruments with version 16.30 or higher with Water Mode 15 installed must not be programmed with *PlanADCP* since *PlanADCP* does not accept the WM15 command. There are two options to program the WM15 command:

1. To program the WM15 command, create a Lowered ADCP script file as normal in *PlanADCP*, then save the script file. Open the script file in a text editor, remove the existing WMxx command and manually insert a WM15 command immediately below the CR1 command.

2. Using a communication terminal, such as *TRDI Toolz*, set up the instrument for deployment by sending the individual commands to the instrument via a script file. Make sure the WM15 command is sent immediately after the CR1 command.

When the WM15 command is used in a command file, place it after the CR1 command and before any other commands to eliminate the risk of changing a previously sent parameter.

For example, when ADCPs, using version 16.30 or higher, receives the WM15 command, the ADCP automatically changes several commands to LADCP appropriate values. It changes the water profile bandwidth to 6.25% by setting WB and LW to 1, the number of water profile pings to 1 by setting WP and LP to 1, and the time per ensemble and time per ping to 1 second by setting TE 00:00:01.00 and TP 00:01.00 respectively.

Conversely, when the ADCP has been using WM15 and receives the WM1 command, the ADCP automatically changes the same command parameters to their factory default values.

When the ADCPs, with version 16.30 or higher, receives a WM1 or WM15 command, the automatic command changes are transparent to the user, who may require other bandwidth, number of pings, time per ensemble, and/or ping values.

Once ADCPs with firmware 16.30 or higher have received the WM15 command, the L commands and the corresponding W commands will have similar values. Changing a W command will automatically update the corresponding L command to match. Changing an L command will automatically update the corresponding W command to match.

If WM15 is not set, the L commands are disabled.

Here is an example of an edited command file set for use with the WM15 command.

```
; Append command to the log file: "C:\adcp\MLADCP.log"
$lC:\adcp\MLADCP.log
;
$P **************************************************************************
$P ****************** LADCP Master. Usually looking down ******************
$P ************* Master and Slave will ping at the same time! *************
$P **************************************************************************
; Send ADCP a BREAK
$B
; Wait for command prompt (sent after each command)
$W62
;**Start**
; Display real time clock setting
tt?
$W62
; Set to factory defaults
CR1
$W62
; Set Water Mode 15 LADCP
WM15
$W62
↓
↓
↓
↓
↓
; Start pinging
CS
; Delay 3 seconds
$D3
$p **************************************************************************
$P Please disconnect the ADCP from the computer.
$P **************************************************************************
; Close the log file
$l
; Exit TRDI Toolz
$X
```

Basic Setup

The basic commands for the Master and Slave ADCP setups are no different from a "standard" deployment. Use the *PlanADCP* program to select the number of bins, bin size, number of pings, ensemble duration, etc. This will set the "basic" commands needed to collect data.

> The Master and Slave command files are included on the Marine Measurement CD. Edit the files as needed.

The following is a basic set of commands that may be used for a WM15 type of deployment:

- 20 bins
- 10 meter bins
- 1 ping per ensemble
- 1 second between ensembles
- 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
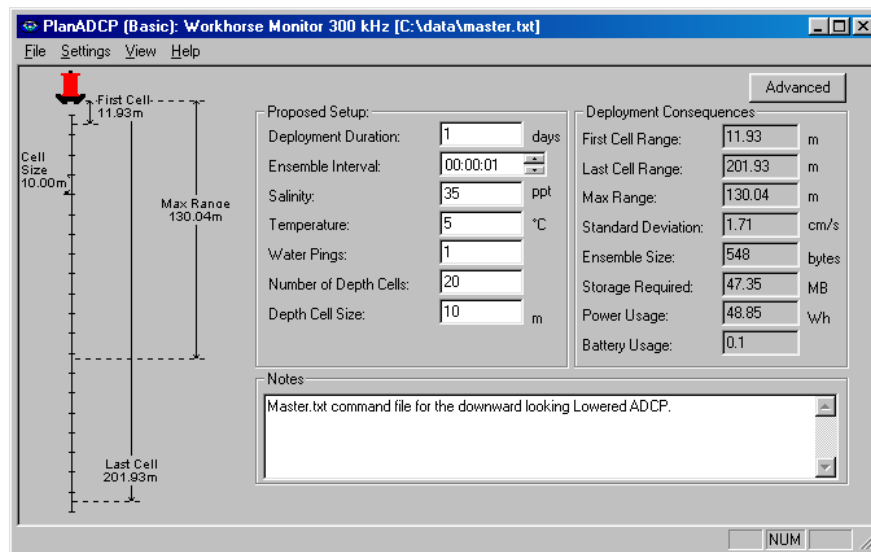- Record data internally

Figure 6.   Plan Setup Screen

Once the basic configuration file is created click **File, Save** and save the file as *Master.txt*. Use **File, Save As** and name the file *Slave.txt*.

> The Master and Slave command files are also included on the Marine Measurement CD. Edit the files as needed.

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Master ADCP Setup

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

> ⚠️ The SB command must be set to SB0 to use the Master/Slave setup.

> 📌 TRDI recommends that the downward facing ADCP be the Master.

Add the following commands to the *Master.txt* file. TRDI suggests following the same format as the rest of the commands and include the line with the semi-colon.

Table 1.   Master ADCP Command File Added Commands

Command	Description
SM1	Sets the Workhorse ADCP as the Master
SA001	Send a synchronizing pulse before each ping
SB0	Disable hardware-break detection on Channel B
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 or SW500	Sets the number of tenths of milliseconds to wait before the Master starts its' ping. A command of SW75 means that the Master will ping within 100 microseconds of the Slave. This effectively makes both systems transmit and receive at the same time. A command setting of SW500 means that the Master will ping 0.5 seconds after the Slave. This will make both systems transmit and receive independently.
$L*filename*	Used by *TRDI Toolz* to turn on the capture of all communications between the ADCP and the computer to a file.
$D3	Used by *TRDI Toolz* to delay for 3 seconds before continuing to the next command. Required during the deployment sequence using TRDI Toolz.
$X	Used by *TRDI Toolz* to exit from the *TRDI Toolz* program.
$W62	Used by *TRDI Toolz* to wait for the command prompt before continuing to the next command. Required during the deployment sequence using TRDI Toolz.

> 📌 Do not include the $L, $D3, $X, or $W62 commands if you intend to use another TRDI supplied deployment software package other than *TRDI Toolz*.

Change the following commands in the *Master.txt* file. Be sure to change the command itself and edit the comment lines following the semi-colon if you make any changes.

Table 2.   Master ADCP Command File Edited Commands

Command	Description
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

The example shown below is the *Master1.txt* command file.

> 📌 The Master1, Master2, and Slave command files are included on the Marine Measurement CD. Edit the files as needed.

```
; Append command to the log file: "C:\adcp\MLADCP.log"
$lC:\adcp\MLADCP.log
;
$P *************************************************************************
$P ******************* LADCP Master. Usually looking down ******************
$P ************** Master and Slave will ping at the same time! *************
$P *************************************************************************
; Send ADCP a BREAK
$B
; Wait for command prompt (sent after each command)
$W62
;**Start**
; Display real time clock setting
TT?
$W62
; Set to factory defaults
CR1
$W62
; Set Water Mode 15 LADCP
WM15
$W62
; Set baud rate to 9600
CB411
$W62
; Save settings as User defaults
CK
$W62
; Name data file
RN MLADCP
$W62
; Set transducer depth to zero
ED0000
$W62
; Set salinity to 35ppt
ES35
$W62
; Set system coordinate.
EX11111
$W62
; SET AS MASTER ADCP
SM1
$W62
; TRANSMITS SYNCHRONIZING PULSE BEFORE EACH WATER PING
SA001
$W62
; Disable hardware-break detection on Channel B
SB0
$W62
; SYNCHRONIZING PULSE SENT ON EVERY PING
SI0
$W62
;WAIT 7.5 MILLISECONDS
SW75
$W62
; Set one ensemble/sec
TE00000100
$W62
; Set one second between pings
TP000100
$W62
; Set LADCP to output Velocity, Correlations, Amplitude, and Percent Good
WD111100000
$W62
; Set one ping per ensemble. Also sets LP command.
WP1
$W62
; Set to record 20 bins. Also sets LN command.
WN020
$W62
; Set bin size to 1000 cm. Also sets LS command.
WS1000
```

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```
$W62
; Set blank to 176 cm (default value) Also sets LF command.
WF0176
$W62
; Set max radial (along the axis of the beam) water velocity to 170 cm/sec.
; Also sets LV command.
WV170
$W62
; Set ADCP to narrow bandwidth and extend range by 10%.
;Also sets LW command.
WB1
$W62
; Set to use a fixed speed of the sound
EZ0111111
$W62
; Set speed of sound value. 1500 m/sec is default.
EC1500
$W62
; Heading alignment set to 0 degrees
EA00000
$W62
; Heading bias set to 0 degrees
EB00000
$W62
; Record data internally
CF11101
$W62
; Save set up
CK
$W62
; Start pinging
CS
; Delay 3 seconds
$D3
$p ************************************************************************
$P Please disconnect the ADCP from the computer.
$P ************************************************************************
; Delay 7 seconds
$D7
; Close the log file
$l
; Exit TRDI Toolz
$X
```

Slave ADCP Setup

There are several commands that must be added to the Slave ADCP command file and several commands to change. Edit the *Slave.txt* command file you created using a standard text editor (i.e., NotePad®).

> ⚠️ **The SB command must be set to SB0 to use the Master/Slave setup.**

> 📌 TRDI recommends that the upward facing ADCP be the Slave.

Add the following commands to the *Slave.txt* file. We suggest you follow the same format as the rest of the commands and include the line with the semi-colon.

Table 3.   Slave ADCP Command File Added Commands

Command	Description
SM2	Sets the Workhorse ADCP as the Slave
SA001	Slave ADCP will wait to ping before each ping
SB0	Disable hardware-break detection on Channel B
ST0300	Sets the Workhorse ADCP to wait up to 300 seconds for the synchronization pulse. Since this example is a WM15 setup, then both Workhorse ADCPs must ping together. If the Slave ADCP times out, it will start pinging on its own and disregards synchronization pulses from the Master.
$L*filename*	Used by TRDI Toolz to turn on the capture of all communications between ADCP and computer to a file.
$D3	Used by TRDI Toolz to delay for 3 seconds before continuing to the next command. Required during the deployment sequence using TRDI Toolz.
$X	Used by TRDI Toolz to exit from TRDI Toolz program.
$W62	Used by *TRDI Toolz* to wait for the command prompt before continuing to the next command. Required during the deployment sequence using TRDI Toolz.

> 📌 Do not include the $L, $D3, $X, or $W62 commands if you intend to use another TRDI supplied deployment software package other than *TRDI Toolz*.

Change the following commands in the *Slave.txt* file. Be sure change the command in both the lines following the semi-colon and the line with the command by itself.

Table 4.   Slave ADCP Command File Edited Commands

Command	Description
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:

> 📌 The Master and Slave command files are included on the Marine Measurement CD. Edit the files as needed.

```
; Append command to the log file: "C:\adcp\SLADCP.log"
$lC:\adcp\SLADCP.log
;
$P **********************************************************************
$P ******************* LADCP Slave. Usually looking up ****************
$P **********************************************************************
; Send ADCP a BREAK
$B
; Wait for command prompt (sent after each command)
```

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```
$W62
;**Start**
; Display real time clock setting
TT?
$W62
; Set to factory defaults
CR1
$W62
; Set Water Mode 15 LADCP
WM15
$W62
; Set baud rate to 9600
CB411
$W62
; Save settings as User defaults
CK
$W62
; Name data file
RN SLADCP
$W62
; Set transducer depth to zero
ED0000
$W62
; Set salinity to 35ppt
ES35
$W62
; Set system coordinate.
EX11111
$W62
; Set as Slave ADCP
SM2
$W62
; LISTENS FOR SYNCHRONIZING PULSE BEFORE EACH PING
SA001
$W62
; Disable hardware-break detection on Channel B
SB0
$W62
; WAIT UP TO 300 SECONDS FOR SYNCHRONIZING PULSE
ST0300
$W62
; Set one ensemble/sec
TE00000100
$W62
; Set one second between pings
TP000100
$W62
; Set LADCP to output Velocity, Correlations, Amplitude, and Percent Good
WD111100000
$W62
; Set one ping per ensemble. Also set the LP command.
WP1
$W62
; Set to record 20 bins. Also set the LN command.
WN020
$W62
; Set bin size to 1000 cm. Also sets the LS command.
WS1000
$W62
; Set blank to 176 cm (default value) Also set the LF command.
WF0176
$W62
; Set max radial (along the axis of the beam) water velocity to 170 cm/sec.
; Also set the LV command.
WV170
$W62
; Set ADCP to narrow bandwidth and extend range by 10%
; Also sets the LW command
WB1
$W62
; Set to use a fixed speed of the sound
```

```
EZ0111111
$W62
; Set speed of sound value. 1500 m/sec is default.
EC1500
$W62
; Heading alignment set to 0 degrees
EA00000
$W62
; Heading bias set to 0 degrees
EB00000
$W62
; Record data internally
CF11101
$W62
; Save set up
CK
$W62
; Start pinging
CS
; Delay 3 seconds
$D3
$p **************************************************************************
$P Please, disconnect the ADCP from the computer.
$P **************************************************************************
; Delay 7 seconds
$D7
; Close the log file
$l
; Exit TRDI Toolz
$X
```

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Creating WM15 Command Files for One ADCP

The following WM15 example shows the basic steps used to configure one Workhorse ADCP for a Lowered ADCP deployment.

Basic Setup

The basic commands for the ADCP setup are no different from a "standard" deployment. Use the *PlanADCP* program to select the number of bins, bin size, number of pings, ensemble duration, etc. This will set the "basic" commands needed to collect data.

The following is a basic set of commands that may be used for a WM15 type of deployment:

- 20 bins
- 10 meter bins
- 1 ping per ensemble
- 1 second between ensembles
- 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 click **File, Save** and save the file as *LADCP.txt*.

> The *LADCP.txt* command file is included on the Marine Measurement CD. Edit the file as needed.

ADCP Setup

There are several commands that must be added to the WM15 command file and several commands to change. Edit the *LADCP.txt* command file you created using a standard text editor (i.e., NotePad®).

> TRDI recommends that the ADCP be facing downward for the deployment.

Add the following commands to the *LADCP.txt* file. We suggest you follow the same format as the rest of the commands and include the line with the semi-colon.

Table 5.   LADCP Command File Added Commands

Command	Description
$L*filename*	Used by *TRDI Toolz* to turn on the capture of all communications between the ADCP and the computer to a file.
$D3	Used by *TRDI Toolz* to delay for 3 seconds before continuing to the next command. Required during the deployment sequence using TRDI Toolz.
$X	Used by *TRDI Toolz* to exit from the *TRDI Toolz* program.
$W62	Used by *TRDI Toolz* to wait for the command prompt before continuing to the next command. Required during the deployment sequence using TRDI Toolz.

> Do not include the $L, $D3, $X, or $W62 commands if you intend to use another TRDI supplied deployment software package other than *TRDI Toolz*.

Be sure to change the command in both the lines following the semi-colon and the line with the command by itself.

Table 6.   LADCP Command File Edited Commands

Command	Description
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 LADCP command file:

> The LADCP command file is included on the Marine Measurement CD. Edit the file as needed.

```
; Append command to the log file: "C:\adcp\LADCP.log"
$lC:\adcp\LADCP.log
;
$P ***********************************************************************
$P ******* LADCP Deployment with one ADCP. Usually looking down **********
$P ***********************************************************************
; Send ADCP a BREAK
$B
; Wait for command prompt (sent after each command)
$W62
;**Start**
; Display real time clock setting
TT?
$W62
; Set to factory defaults
CR1
$W62
; Set Water Mode 15 LADCP
WM15
$W62
; Set baud rate to 9600
CB411
$W62
; Save settings as User defaults
CK
$W62
; Name data file
RN MLADCP
$W62
; Set transducer depth to zero
ED0000
$W62
; Set salinity to 35ppt
ES35
$W62
; Set system coordinate.
```

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```
EX11111
$W62
; Set one ensemble/sec
TE00000100
$W62
; Set one second between pings
TP000100
$W62
; Set LADCP to output Velocity, Correlations, Amplitude, and Percent Good
WD111100000
$W62
; Set one ping per ensemble. Also sets the LP command.
WP1
$W62
; Set to record 20 bins. Also sets the LN command.
WN020
$W62
; Set bin size to 1000 cm. Also sets the LS command.
WS1000
$W62
; Set blank to 176 cm (default value). Also sets the LF command.
WF0176
$W62
; Set max radial (along the axis of the beam) water velocity to 176 cm/sec.
; Also sets the LV command.
WV170
$W62
; Set ADCP to narrow bandwidth and extend range by 10%
; Also sets the LV command.
WB1
$W62
; Set to use a fixed speed of the sound
EZ0111111
$W62
; Set speed of sound value. 1500 m/sec is default.
EC1500
$W62
; Heading alignment set to 0 degrees
EA00000
$W62
; Heading bias set to 0 degrees
EB00000
$W62
; Record data internally
CF11101
$W62
; Save set up
CK
$W62
; Start pinging
CS
; Delay 3 seconds
$D3
$p ****************************************************************************
$P Please disconnect the ADCP from the computer.
$P ****************************************************************************
; Delay 7 seconds
$D7
; Close the log file
$l
; Exit TRDI Toolz
$X
```

Cables and Interconnections

Use the following figures to interconnect the ADCP's.
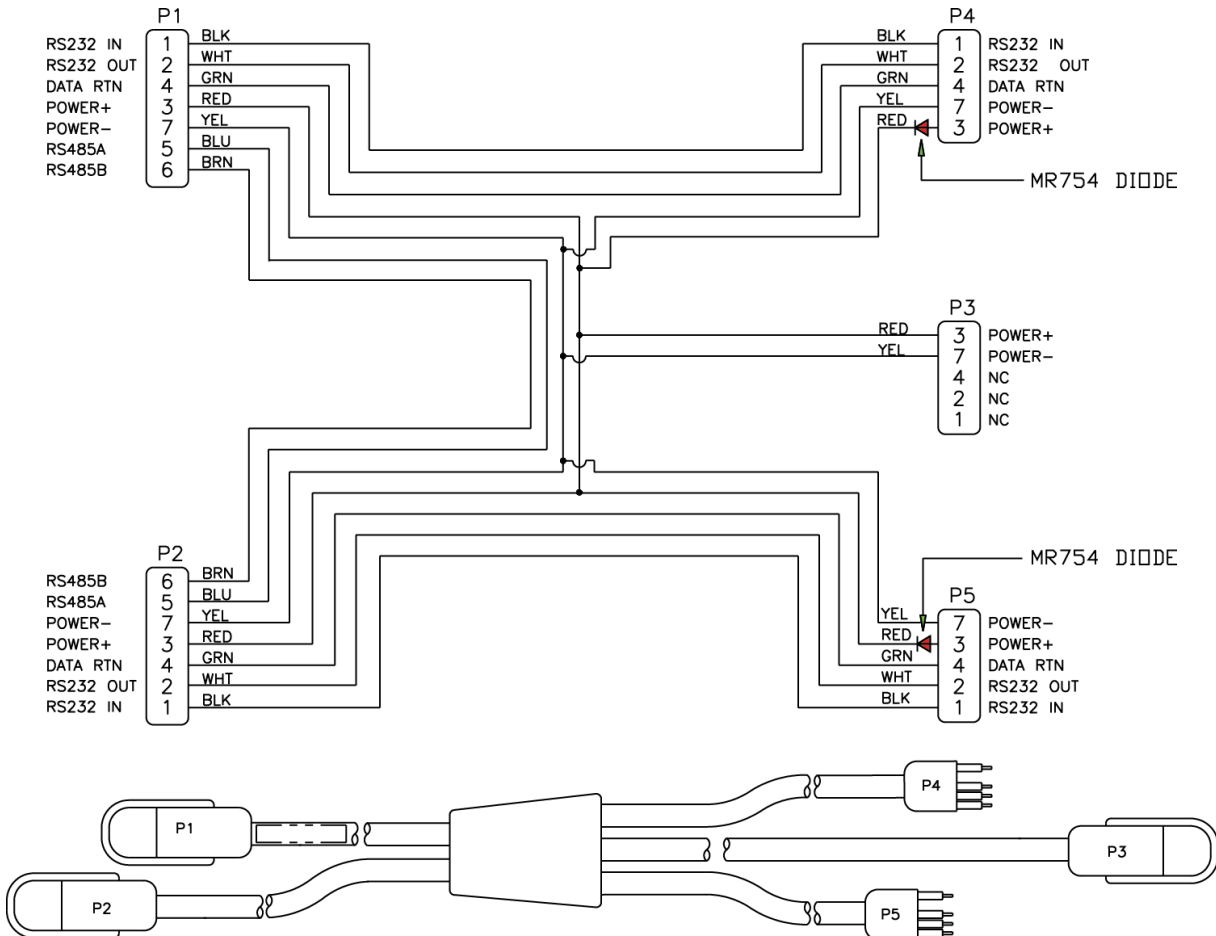
Figure 7.   WM15 Star Cable

⚠️ To avoid having "hot pins" TRDI recommends disconnecting P3 **before** connecting P4 or P5.

Note that there is no diode protection at the P3 connector. Power applied at P4 or P5 will send DC Volts on the pins of P3. This was done on purpose as customers may want to "recharge" the external battery packs while powering the ADCPs to download the data.

📝 Cable 737-3043 (shown) has a female P3 connector. Cable 737-3104 has male P3 connector.

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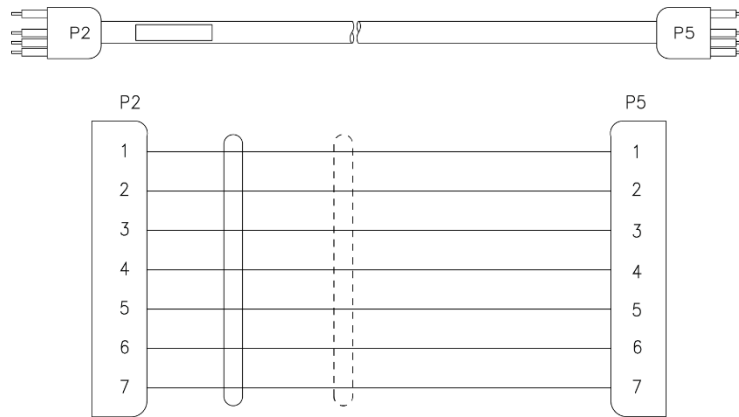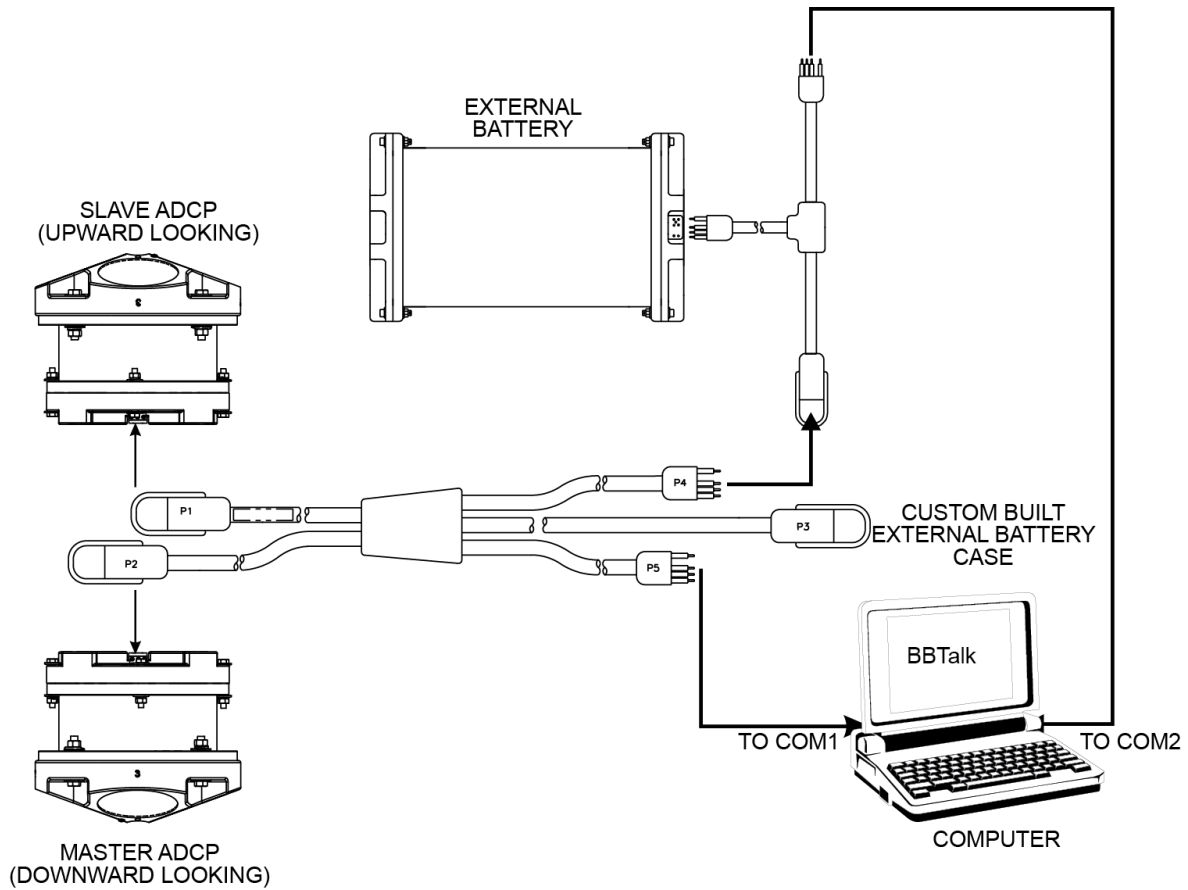**Figure 8.   730-6057 Male to Male Cable**

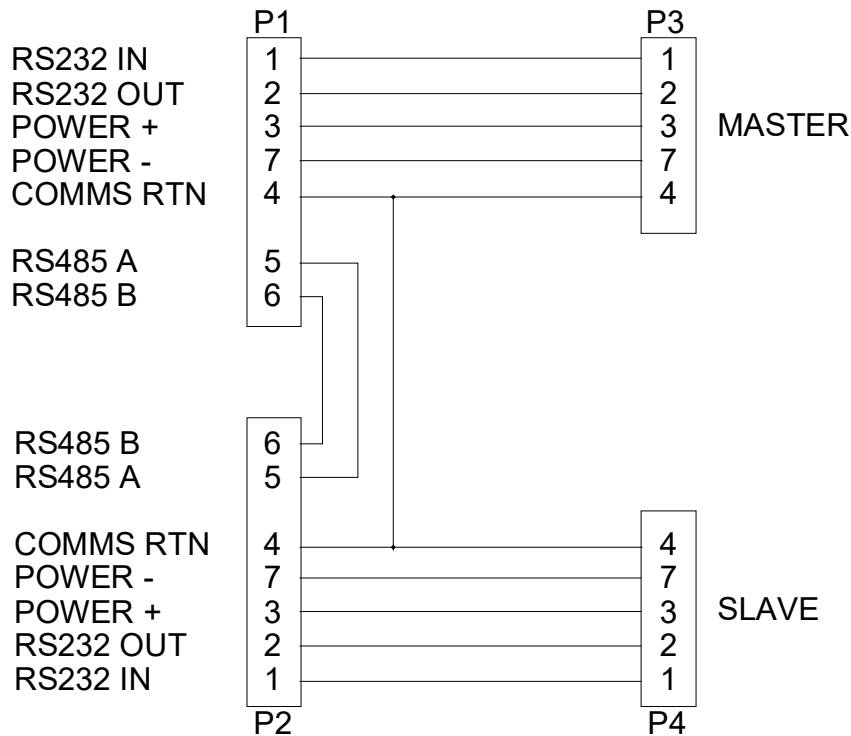**Figure 9.   WM15 Interconnections with Star Cable**

⚠ To avoid having "hot pins" TRDI recommends disconnecting P3 **before** connecting P4 or P5.

📌 This is the recommended configuration. Both ADCPs must be using 9600 Baud.

Other WM15 Cables

The following cables and interconnections are alternate configurations that can be provided by Teledyne RD Instruments.


```
                         P1                  P3
RS232 IN                  1 ─────────────── 1
RS232 OUT                 2 ─────────────── 2
POWER +                   3 ─────────────── 3    MASTER
POWER -                   7 ─────────────── 7
COMMS RTN                 4 ─────────────── 4

RS485 A                   5
RS485 B                   6


RS485 B                   6
RS485 A                   5

COMMS RTN                 4 ─────────────── 4
POWER -                   7 ─────────────── 7
POWER +                   3 ─────────────── 3    SLAVE
RS232 OUT                 2 ─────────────── 2
RS232 IN                  1 ─────────────── 1
                         P2                  P4
```

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

Figure 10.   Master/Slave Cable Wiring

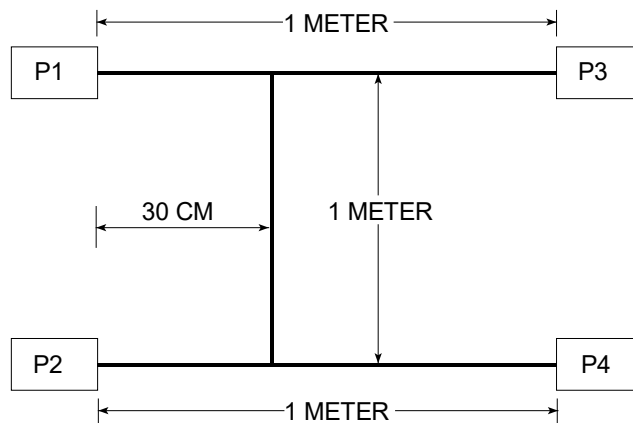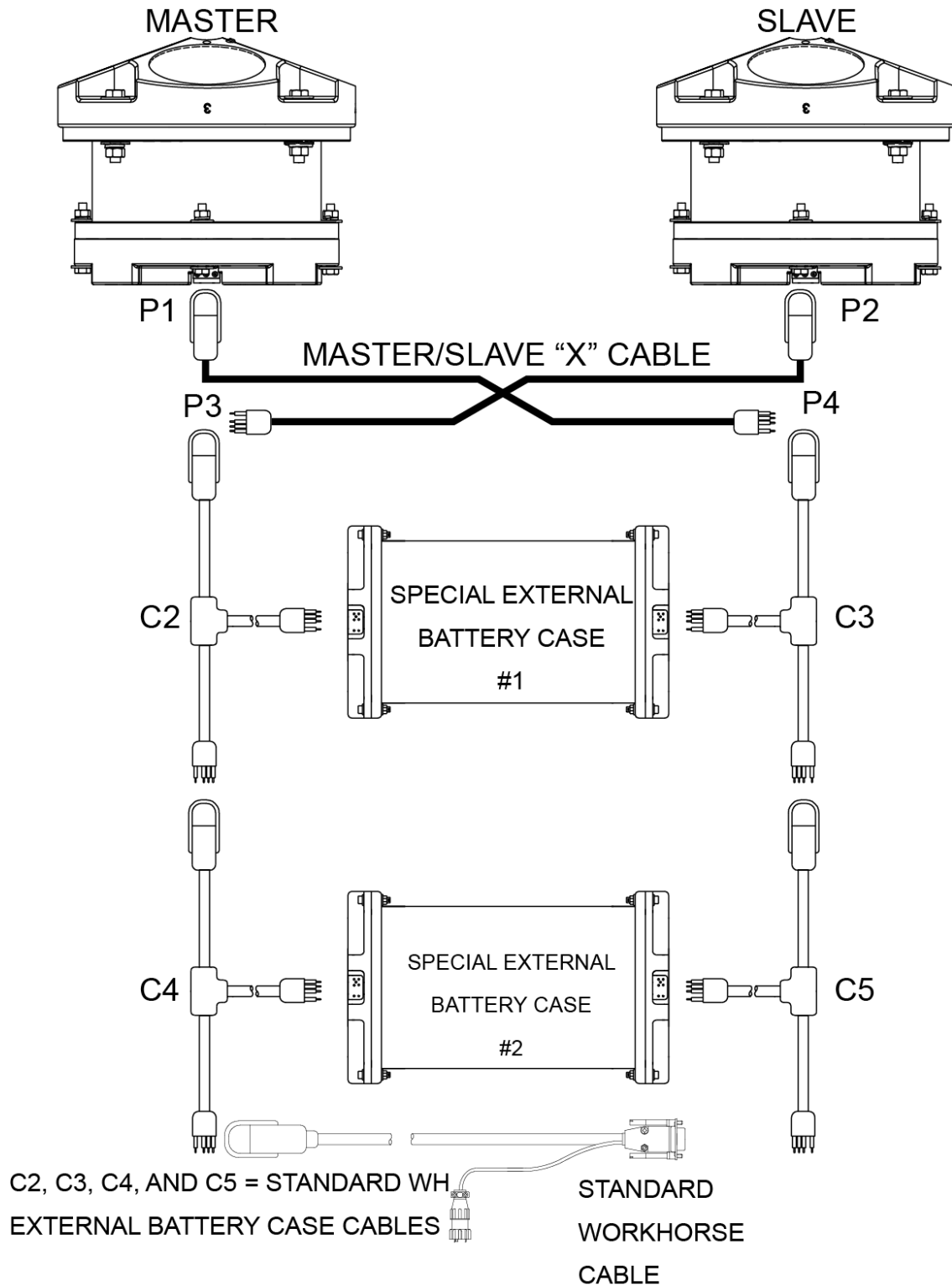**Figure 11.   Master/Slave Cable Length**

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MASTER   SLAVE

P1   P2

MASTER/SLAVE "X" CABLE

P3   P4

C2   SPECIAL EXTERNAL   C3
                      BATTERY CASE
                           #1

C4   SPECIAL EXTERNAL   C5
                      BATTERY CASE
                           #2

C2, C3, C4, AND C5 = STANDARD WH   STANDARD
EXTERNAL BATTERY CASE CABLES   WORKHORSE
                                                    CABLE

Figure 12.   Lowered ADCP Interconnections

MASTER

SLAVE

P1

P2

MASTER/SLAVE "X" CABLE

P3

P4

C2

EXTERNAL
BATTERY CASE
#1

EXTERNAL
BATTERY CASE
#2

C3

C2, C3 = STANDARD WORKHORSE
EXTERNAL BATTERY CASE CABLES
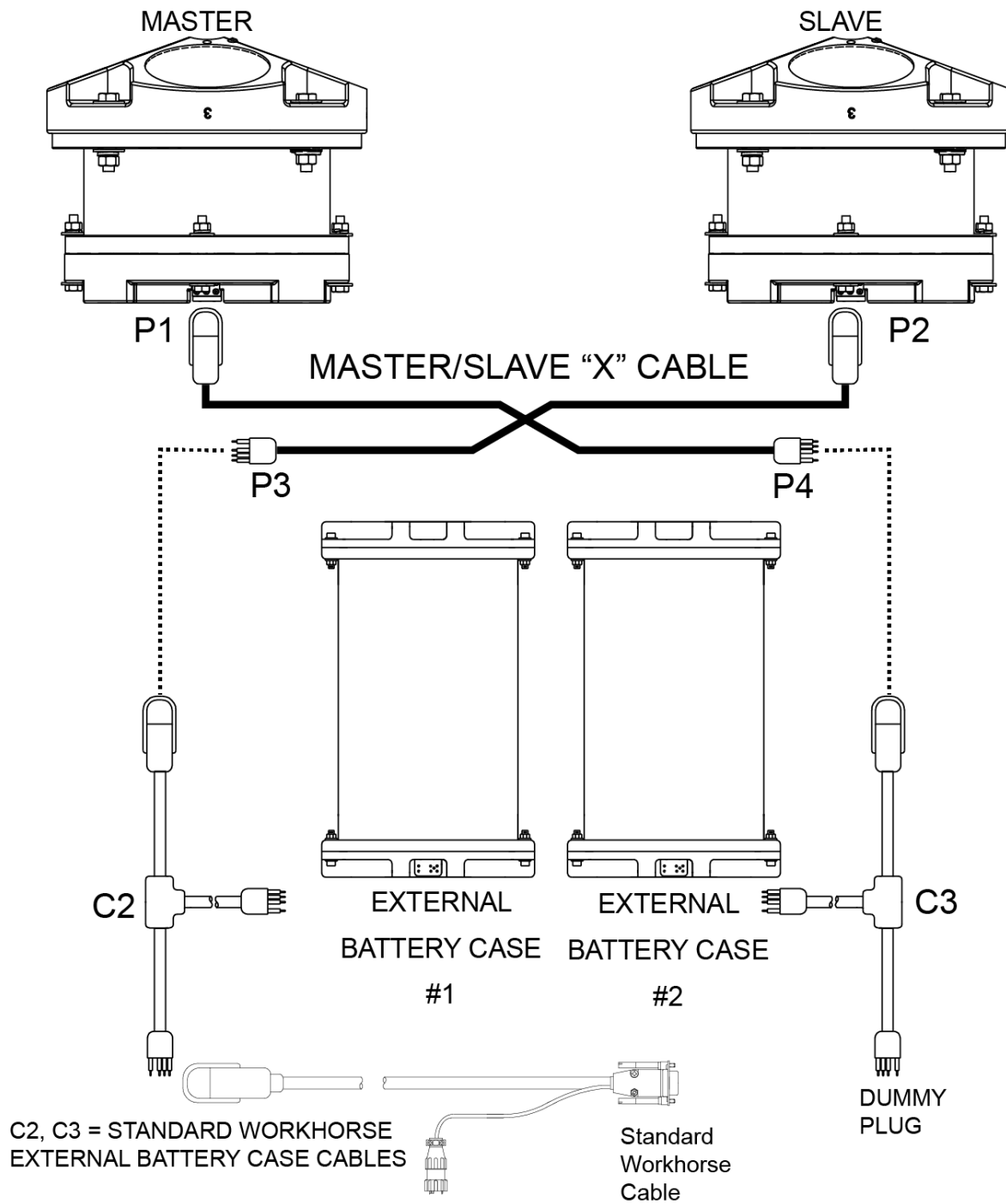
Standard
Workhorse
Cable

DUMMY
PLUG

Figure 13.   Master/Slave Cable Connections Using Standard External Battery Cases

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