

DILLON



ED-2000plus Electronic Dynamometer with HR-2000 Remote User's Manual

UNITED STATES

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CANADA

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la Class A prescrites dans le Reglement sur le brouillage radioelectrique que edicte par le ministere des Communications du Canada.

EUROPEAN COUNTRIES

WARNING

This is a Class A product. In a domestic environment this product may cause radio interference in which the user may be required to take adequate measures.



CAUTION

Risk of electrical shock. Do not remove cover. No user serviceable parts inside. Refer servicing to qualified service personnel.

Weigh-Tronix reserves the right to change specifications at any time.

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—This manual is for reference only.—

Pages are numbered consecutively beginning with the cover page.

ED-2000plus Specifications

Capacities:	2,000 x 0.5 lb	1,000 x 0.2 kg	10 x 0.002 kN	1 x 0.0002 T
	5,000 x 1 lb	2,000 x 0.5 kg	20 x 0.005 kN	2 x 0.0005 T
	10,000 x 2 lb	5,000 x 1 kg	50 x 0.01 kN	5 x 0.001 T
	20,000 x 5 lb	10,000 x 2 kg	100 x 0.02 kN	10 x 0.002 T
	50,000 x 10 lb	20,000 x 5 kg	200 x 0.05 kN	20 x 0.005 T
	100,000 x 20 lb	50,000 x 10 kg	500 x 0.1 kN	50 x 0.01 T
Construction:	Aluminum alloy (2-, 5-, and 10,000 lb) Stainless steel (20-, 50-, and 100,000 lb)			
Enclosure:	NEMA 4X / IP66 (sealed against dust, hosedown, and corrosive agents)			
Units of measure:	Selectable pounds, kilograms, kiloNewtons, metric tons. The selected unit of measure is saved when the power is switched off.			
Accuracy:	0.1% of rated capacity			
Repeatability:	0.1% of rated capacity			
Display update rate:	2 times per second			
Internal update rate:	Normal mode: 8 times per second Peak hold: 60 times per second			
Ultimate safety factor:	5:1			
Display:	6 LCD digits, 0.9" (22.5 mm) height			
Outputs:	RS-232 output from dynamometer or Radio-Link remote display unit.			
Annunciators:	LB, KG, KN, TONN, PH (peak hold), BAT (low battery)			
Control keys:	On/Off, Test, Clear/Zero, Peak hold, Function key, Units			
Power:	Standard 9V battery, alkaline or lithium. The ED-2000plus has approximately 200 hours of use with the 9V alkaline battery. Battery life can be extended with the use of a 9V lithium battery. These values represent “average” use; mode of operation, typical period of use, battery recovery, and other variables determine the ultimate battery life. With the optional radio link installed, the 9V battery life is approximately 36-48 hours.			
Operating temp:	-4° to 140°F (-20° to 60°C)			
Calibration:	Traceable to the National Institute of Standards and Technology (NIST). Calibration Certificate with each unit.			
Optional Radio link:	Open air range: Up to 300 feet Update rate: 2 times per second RF signal output: 0 dBm in 50 at 25 C in accordance to FCC Part 15.249, and in Canada under TRS RSS-210. Frequency: 916.5 MHz			

ED-2000plus Introduction



Attention

The ED-2000plus is not suitable for use in magnetic environments.

The ED-2000plus dynamometer is an electronic portable force or weight measurement instrument.

The ED-2000plus is available with low-power radio communications. This option permits wireless communication between the ED-2000plus and an HR-2000 handheld remote display. The ED-2000plus system offers additional flexibility by the ability to have several (up to 255) devices controlled by a single HR-2000 display. This is called a multidrop system.

Data can be extracted from either the ED-2000plus or the HR-2000. This data can be sent to a computer by pressing the **DATA SEND** key or requested by the computer by sending an ENQUIRE code.

This guide describes the operation of the ED-2000plus series of Dillon electronic dynamometers and the procedures for configuring the device to your specific needs.

The display consists of six 7-segment digits and six annunciators which appear when appropriate. See Figure 1 below.

There are three modes of operation:

- Normal operating mode, which covers the daily use of the device.
- Device information mode, allows information about the device to be viewed but not edited. Information that can be viewed includes serial number, range, date of last calibration, etc.
- Configuration mode, which enables the user to configure the device.

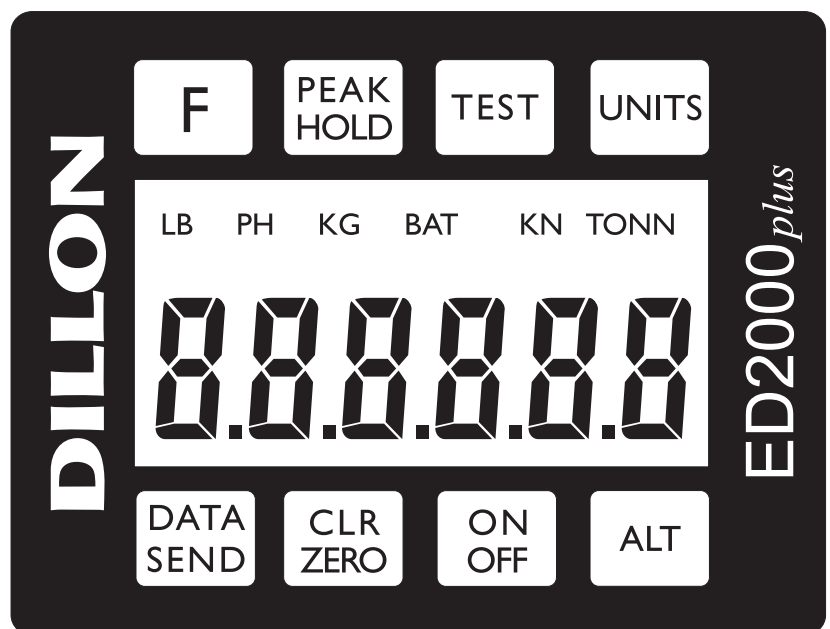


Figure 1
Electronic Dynamometer Front Panel

Normal Operation Mode

During normal operation mode most of the basic functions are available by pressing one key. Some of the functions require that the F-key is pushed simultaneously. This is indicated by F+[key]. Table 1 explains the key functions.

Key	Function	Display
ON/OFF	Hold for ½ second to turn unit on. On start-up the device is initialized and starts measuring with previous units selected. ON/OFF key is disabled in peak hold, device information and configuration modes.	Shows the current gross value with the appropriate annunciator visible (LB , KG , KN or TONN). With Version 3.0 software the display will show OFF 3A when turning the unit off.
CLR/ZERO	Tare the device and show net reading.	Reads net force value. Can be positive or negative. Can tare up to 100% of capacity.
SEND DATA	Send displayed information via RS-232	No change in the display.
ALT	Not used with the ED-2000plus	
F+CLR/ZERO	Reverts to gross reading.	Shows the gross force value.
UNITS	Scrolls through the four possible units of measure and converts the reading to the selected unit. Selected unit of measure is saved when power is switched off.	The units legends will change in the sequence LB->KG->KN->TONN->LB etc., and the display will update accordingly.
F+PEAK HOLD	Toggles the device between normal and peak hold mode. In peak hold mode it will update the reading at 60 times per second.	Activates the " PH " annunciator if in peak hold mode. The annunciators will flash and the top segment of the left most digit will illuminate to indicate maximum is being displayed.
PEAK HOLD	If the device is in peak hold mode, toggles between minimum and maximum readings.	The top segment of the left most digit illuminates if maximum reading is being displayed. The bottom segment illuminates if the minimum reading is being displayed.
TEST	Performs an internal shunt test of the measuring bridges. (You must hold the key down until the display stabilizes.)	A value is displayed that is within $\pm 0.1\%$ of capacity in the currently selected measuring units. If displayed value is greater than $\pm 0.1\%$, recalibrate the unit. Depending on the filter value currently selected (see Configuration Mode), the display may take some time to settle to a stable reading.
F+UNITS	Switches device from normal operating mode to device information mode.	
F+TEST	Switches device from operating mode to configuration mode.	
F+ON (from power off)	Puts device in RS-232 mode. This function also conserves battery life. If you are not using the radio function, we recommend placing the device in RS-232 mode.	

Table 1
Key Functions in Normal Operation Mode

RS-232 Operation

The force value received is right justified with any leading zeroes replaced by spaces. Negative values will show a minus sign before the first digit. The decimal point will not be printed if it follows the significant digits.

You can operate the ED-2000plus with a computer or other data logging device via RS-232. To place the ED-2000plus in RS-232 mode, use one hand to press and **hold** the **F** key and use the other hand to press the **ON** key. This operation is transparent to the user. It is important that the ED-2000plus and the external device are set at a baud rate of 2400 for RS-232 communication.

When you press the **DATA SEND** key in RS-232 mode, or send an enquire code from the external device to the ED-2000plus, the following information is sent to the external device:

xxxxx.x uu CR/LF

x = force value

u = unit of measure (LB, KG, KN or T)

CR/LF = carriage return and line feed

The enquire code is a single question mark (?). When the ED-2000plus receives this code from the external device, the above information is sent.

If your RS-232 port is receiving garbled data, check to be sure you are in RS-232 mode or that an HR-2000 is not trying to communicate with the ED-2000plus by radio.

Device Information Mode

To activate the device information mode from normal operating mode use one hand to press and **hold** the **F** key and use the other hand to press the **UNITS** key. Return to normal operations by using one hand to press and **hold** the **F** key and use the other hand to press the **CLR/ZERO** key.

Upon entering device information mode, the selected unit annunciator will flash (indicating that the device is out of the normal operating mode) and the display will show the device serial number. Use the keys described in Table 2 to view the information fields described in Table 3.

Key	Function	Display
PEAK HOLD	Scroll down the list of information fields, i.e. the next field in the list.	The "label" for the field is shown briefly when the key is kept depressed. The actual information value is then shown.
TEST	Scroll up the list of information fields, i.e. the previous field in the list	Same as for PEAK HOLD
UNITS	Show the label of the current information field.	Same as for PEAK HOLD
F+CLR/ZERO	Return to normal operating mode.	

Table 2
Key Function in Device Information Mode

Table 3 contains the information fields and typical values you can view in the device information mode. The fields appear in the sequence shown. Scrolling past the last item in the list will return the display to the first item in the list.

Label	Typical Display	Description
SErno	512056	The device serial number (6 digits).
Eltno	201360	Load element number.
SoFt	2.60	The software release number.
rAnGE	20' Lb	Device range in 1,000s of pounds.
C-dAt	96.08.02	Year, Month and Day of last calibration.
C-rEF	100123	Reference to calibration document number (6 digits).
C-cnt	3	Total number of calibrations performed.
OLOAd	0	Number of times the device has been overloaded beyond 125% of full capacity.
Addr	100	The communication address assigned to the device in multidrop applications.

Table 3
Device Information Fields

Configuration Mode

To activate the configuration mode from normal operation, use one hand to press and **hold** the **F** key and use the other hand to press the **TEST** key. Return to normal operations by using one hand to press and **hold** the **F** key and use the other hand to press the **CLR/ZERO** key.

Upon entering configuration mode, the selected unit annunciator will flash (indicating that the device is out of the normal operating mode) and the display will show the current value for setpoint 1.

The configuration values may be changed and permanently stored in nonvolatile memory within the device. Consequently, use these functions with care. Note that the values will be changed immediately in the EEPROM, but some changes will only take effect when the unit is switched off and then back on. These values are noted with an asterisk in the "Label" column of Table 5

Table 4 shows the keys you use to set configuration to your needs. Table 5 contains the configuration items you can view and change.

Key	Function	Display
PEAK HOLD	Scroll down in list of information fields, i.e. the next field in the list.	The "label" for the field is shown briefly when the key is kept depressed. The actual information value is then shown.
TEST	Scroll up in list of information fields, i.e. the previous field in the list.	Same as for PEAK HOLD .
UNITS	Show the label of the current information field.	Same as for PEAK HOLD .
F+PEAKHOLD	Increment the value shown with wraparound.	Dependent upon function selected.
F+TEST	Decrement the value shown with wraparound.	Dependent upon function selected.
F+CLR/ZERO	Return to basic function mode.	

Table 4
Key Functions in Configuration Mode

Table 5 contains the information fields and typical values you can view in the configuration mode. The fields appear in the sequence shown. Scrolling past the last item in the list will return the display to the first item in the list.

Disabling the Radio-Link Software to Save Battery Power

The ED-2000plus software allows you to use the Radio-Link option. If the Radio-Link option is installed but not being used, disable the radio portion of the software to increase battery life. Also, if your system is not equipped with the Radio-Link option, disable the software.

To disable the Radio-Link software see the **SErch** section in Table 5 below. Notice that the change will not take effect until the ED-2000plus has been switched off and then back on.

Label	Typical Display	Description
SEt-1**	100	Typically not used.
SEt-2**	110	Typically not used.
FiLt	2	Filter values (damping factors) on the load cell signal. Acceptable values are from 0 (no damping) to 7 (maximum damping).
SErch*	rS-485 rAdio	Changes the serial communication link between RS-485 and radio link. Press F + TEST key to toggle between the two choices. Select RS-232 communication by depressing F+ON/OFF at power up and RS-485 and radio will be bypassed.
Addr*	100	The communication address assigned to the device in multidrop applications. Values should be between 33 and 255.
bAud*	2400	Communication baud rate. Available values are 300, 1200, 2400, 4800, 9600, and 19,200 baud. System default is 2400 baud. Radio communication at 2400 baud by default.

* Change takes effect only after the unit has been switched off and then back on.
** Used only in special software applications

Table 5
Configuration Items

Sleep Mode

Sleep mode is a non-configurable battery saving feature of the ED-2000plus. It functions all the time. If signal changes from the strain gages are not received by the microprocessor, certain high drain functions are shut down. The display does not change and any communication with the unit or signal from the gages reactivates the unit instantly. The function of the sleep mode is transparent to the user.

Battery Replacement

ED-2000plus connected to an HR-2000 by wire receives power from the HR-2000. A battery is not recommended in the ED-2000plus in this situation.

The HR-2000 does not contain a low battery detector. It merely displays the low battery warning from the loadcell. Because of this, change batteries in both the ED-2000plus and HR-2000 when the battery warning lights up. (Radio-Link systems only)

When the low battery annunciator appears, you have approximately five hours of usage left. To change the nine-volt battery in the ED-2000plus, follow these steps:

1. Remove the two knurled thumb screws from the battery compartment cover. (Be careful not to lose these screws.) See Figure 6.

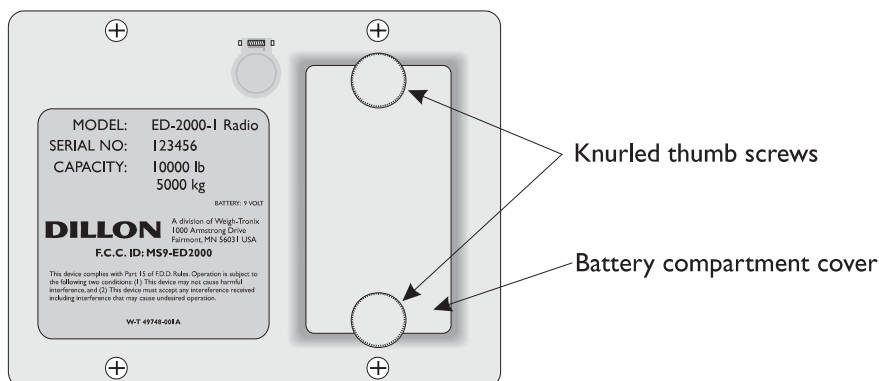


Figure 6
Battery compartment cover

2. Remove the battery compartment cover.
3. Slide the battery down and pry the free end of the battery out of the compartment opening. See Figure 7.

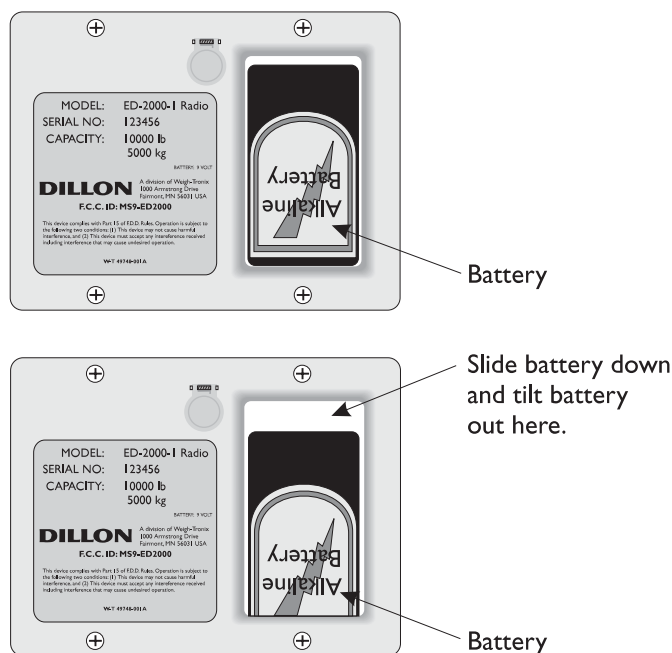


Figure 7
Battery removal

4. Pull the battery out of the compartment and disconnect the battery from the battery lead.
5. Connect new battery to the lead and reverse the disassembly procedure.

HR-2000 Introduction and Operation

Introduction

*To reduce battery drain when not using the Radio-Link option, with the HR-2000 unit on, press both the **PEAK/HOLD** and the **ON/OFF** key. This disables the radio portion of the software and will increase battery life.*

Addresses

High frequency signals are subject to absorption by the ground and the atmosphere, as well as reflections from metallic surfaces. For low power systems, it is normal that variations of range will be experienced, even in "open air" conditions in different environments. Due to combinations of absorption and reflection, pockets with weak and strong signals will be experienced inside the range.

The dominant absorption factor is the ground. As a general rule, the higher the antennas are above the ground, the better the signal.

The HR-2000 operates as a remote keyboard and display for the ED-2000plus electronic dynamometer. Communication between the HR-2000 and the ED-2000plus takes place in RS-485 format via cable or low power radio communication.

The HR-2000 has the following communication parameters "hardwired" into the device.:

- Communication mode: RS-485 half duplex
- Baud rate: 2400 bits per second
- Own address: Configurable
- Initial remote address: Last address used

Addresses are important with the ED-2000plus and HR-2000 because of the manner in which they communicate. The HR-2000 sends out a signal (poll signal) requesting that the instrument with a specific address send its display reading. The ED-2000plus looks at the poll signal that the remote sent and determines if the address matches. If it does match, the ED-2000plus responds with its reading.

The concept of addresses is relatively transparent if the system consists of a single ED-2000plus and an HR-2000. The system will communicate with little (if any) addressing ever required. However, if several ED-2000plus instruments are in the same area, they each need to be uniquely identified so that the HR-2000 knows which ED-2000plus it is talking to.

If several HR-2000 remotes are in the same area, each remote needs to know when it is its turn to use the airwaves. This is also accomplished by assigning the remote a unique address, and by telling it how many other remotes are in the area.

The following pages describe the operation of the HR-2000, both in one-on-one and multiple applications.

Operation

The key functions for the HR-2000 are listed in Table 6.

Key	Function	Display
ON/OFF	Turns the unit on in radio mode. RS-485 wireline communication will also function.	rAdio
F + ON/OFF (while unit is off)	Press these two keys to power up the unit in RS-485 wireline mode. This disables radio function and preserves battery life.	rS-485
F+ ON/OFF (while unit is on)	Puts the unit into addressing mode and shows the address that is to be polled.	SEtuP-100
PEAKHOLD	Increments the address by 1 count.	101
TEST	Decrements the address by 1 count	99
F + PEAK/HOLD	Increments the address by 10	110
F + TEST	Decrements the address by 10	90
F + ON/OFF	Returns unit to normal display mode.	-donE-
ON/OFF	Turns the unit off	OFF
ALT + ON (while unit is off)	Forces unit into RS-232 mode	-duAL-
F + ALT	Places remote in LISTEN mode. The remote waits for a poll signal from the attached peripheral, requests the reading from the ED-2000plus and returns the reading to the peripheral.	LiStEn
UNITS	Press this to save changes and move to the next item. Hold the UNITS key to see the item name, release it to see the value.	See Table 7 headings

Table 6
Key Functions for HR-2000

Powering Up

For Radio Communication

While operating the HR-2000, the lower part of the leftmost digit may be observed to flash. This occurs when the HR-2000 wants to transmit a message and is waiting for access or for an answer. Operating under good radio conditions, this will be rarely seen.

To power up for use with the radio link, press the **ON/OFF** key on the ED-2000plus then the press the **ON/OFF** key on the HR-2000.

When you turn on the HR-2000 for radio use, the display will show the software revision number (probably **hr2001**), then the word **rAdio**. Until the corresponding ED-2000plus is powered up and communicating with the HR-2000, the letter **r** will flash back and forth between inverted and upright. When communication is established and working properly the display will mirror the ED-2000plus display and the leftmost decimal point will blink every ½ second. If communication is broken, the display will flash a small **o** in the lower left corner of the display. If communications are not resumed within ten seconds, the display will show **rAdio** and the letter **r** will flash back and forth between inverted and upright.

Radio Operation with RS-232

The force value received is right justified with any leading zeroes replaced by spaces. Negative values will show a minus sign before the first digit. The decimal point will not be printed if it follows the significant digits.

WARNING!

HR-2000 is intended to send only force/weight readings. Although the HR-2000 can remotely configure an ED-2000plus, unpredictable output may result if Print or Enquire actions occur while the ED-2000plus is in configuration mode.

You can connect the HR-2000 with a computer or other data logging device via RS-232. There are two communication modes for the HR-2000; normal operation mode and listen mode. It is important that the ED-2000plus, the HR-2000 and the external device all be set at a baud rate of 2400 for RS-232 communication.

In normal operating mode, the ED-2000plus and HR-2000 are in constant contact and the HR-2000 screen reflects what the ED-2000plus screen shows. Information can be sent to an external device by pressing the **DATA SEND** key on the HR-2000.

In listen mode, the HR-2000 waits to receive an enquire code from the external device, polls the ED-2000plus for the information, then returns it to the external device.

To enter listen mode, use one hand to press and **hold** the **F** key and use the other hand to press the **ALT** key. In listen mode the display shows the word LISTEN and keys are nonfunctional.

Following is the format of the information sent to the external device:

xxxxx.x uu CR/LF (if in LISTEN mode, a less than symbol (<), ASCII code 62, is also sent after the line feed)

x = force value

u = unit of measure (LB, KG, KN or T)

CR/LF = carriage return and line feed

The enquire code for the HR-2000 is a question mark plus a carriage return (?, CR or ASCII Codes 63, 13). When the HR-2000 receives this code from the external device, the above information is sent.

The action of sending information or polling for information can introduce delays in communication between the HR-2000 and ED-2000plus.

If your HR-2000 does not automatically detect the RS-232 connection, turn off the unit, then power up by using one hand to press and **hold** the **ALT** key and using the other hand to press the **ON** key. This forces the unit into RS-232 operation.

For Wireline Communication

To power up for use with wired communication, use one hand to press and **hold** the **F** key and use the other hand to press the **ON/OFF** key. Powering up this way will turn off the radio communication and save battery power in the HR-2000.

When you turn on the HR-2000 for wireline communication, the display will show the software revision number (probably **hr2001**), then **rs-485**. When communication with the connected ED-2000plus is established the display will mirror the ED-2000plus display and the leftmost decimal point will blink every ½ second. If communication is broken with the ED-2000plus, the display will show a small **o** in the lower left of the display. If communication is not resumed within ten seconds the display will show **rs-485** and the letter **r** will flash back and forth between inverted and upright.

Addressing Mode

You can set the address for each HR-2000 and ED-2000plus operating in a given area so that they can work without interference. If several systems are operating in the same airspace each HR-2000 and ED-2000 must have a unique address. Since more instruments must share the same airwaves, the update time for each unit will increase. Approximate times are shown in Table 7.

It is recommended to keep the ED-2000plus instrument addresses at 100 or higher.

In multiple system environments the remotes must have their Source addresses and Poll parameters set appropriately. The source address must start from address 32 and increase sequentially. The poll value must be equal to the number of HR-2000s in the area.

You need to set the addresses according to the number of systems you have operating in the area. See Table 7 below for the proper settings.

Number of HR-2000s	HR-2000 Source address	Poll value	ED-2000plus Destination address	Update time
2	32	2	100	1 second
	33	2	101	1 second
3	32	3	100	1.5 second
	33	3	101	1.5 second
	34	3	102	1.5 second
4	32	4	100	2 second
	33	4	101	2 second
	34	4	102	2 second
	35	4	103	2 second

Table 7
Addresses for multiple systems

The Destination address must match with the address entered in the ED-2000plus. This value has a default of 100.

Entering a destination address of 0 will cause the remote to send a signal called a "Broadcast signal". The first ED-2000plus that responds with its value will then be locked in.

To assign the correct address for each part of the system, you must access the address mode. Follow these steps to access and set the proper address.

1. With one hand, press and **hold** the **F** key and use the other hand to press the **ON/OFF** key. . .

SEtuP is displayed then **100**. This is the Destination address currently assigned to the ED-2000plus.

2. Increment or decrement the address number using the keys described in Table 6 until the address you want is on the screen.

Remember to follow the recommendations in Table 7.

3. Press the **UNITS** key to save the change and move to the next item in the address mode. . .

SourceE is displayed while the **UNITS** key is held then the Source address is displayed when the key is released. This is the address currently assigned to the HR-2000.

4. Increment or decrement the address number using the keys described in Table 6 until the address you want is on the screen.

Remember to follow the recommendations in Table 7.

5. Press the **UNITS** key to save the change and move to the next item in the address mode. . .

POLL is displayed while the **UNITS** key is held then the poll value is displayed when the key is released. This value identifies the number of remotes that may be operating in a given airspace. This value has a default of one. Changing the value will have the effect of increasing the time between display updates.

6. Increment or decrement the address number using the keys described in Table 6 until the address you want is on the screen.

Two special modes can be flagged with the Poll value:

- A Poll value of zero places the remote in Manual Poll mode. The remote will only poll the instrument when the UNITS key is pressed by the operator. The ED-2000plus will reply and the HR will display the reading until the unit is polled again (or until the screen blanks after ten seconds of non communication). Manual poll mode is designed for situations in which constant updates are not necessary, to conserve battery life or reduce airwave clutter.
- A Poll value of 255 places the unit in Monitor mode. The instrument is completely passive and only **ON/OFF** or **F+ON/OFF** keys are functional. It will need a second HR-2000 operating actively, and the **dEStin** and **Source** address must match the active HR-2000 exactly. The passive HR-2000 will display any traffic FROM the ED-2000 TO the active HR-2000, as long as it is within receiving distance. Monitor mode is designed for situations where a second remote is required for the same ED-2000plus.

7. Press the UNITS key to save the change and move to the next item. . .

dEStin is displayed while the key is pressed then the destination value. You are now back at the top of the list of items in address mode.

Appendix - Weighing and Force Measurement Practice

Load Centering

The basis for all electronic force measurement or weighing is measurement of stress in a loadcell body. To obtain optimal results it is necessary to establish a few basic rules, otherwise the effect may be a nonlinear or nonrepeatable response. Read and follow these tips and see the illustrations on the next page.

For accurate performance the force acting on the unit must be in line with the unit. Centering the load is accomplished by using the shims on each side of the load cell so that it is centered on the shackle pin. See the illustration at right. The 20, 50, and 100 Klb ED-2000plus also include spacers supplied with shackles.

Good Pin Fit

A good fitting pin is important in order to generate an even stress distribution and avoid yield stresses. The ED-2000plus are designed with the recommended shackle pin hole sizes for the Crosby shackle capacity. To achieve published accuracy you must use the shackle pins and centering spacers provided by Dillon.

Torque and Bending

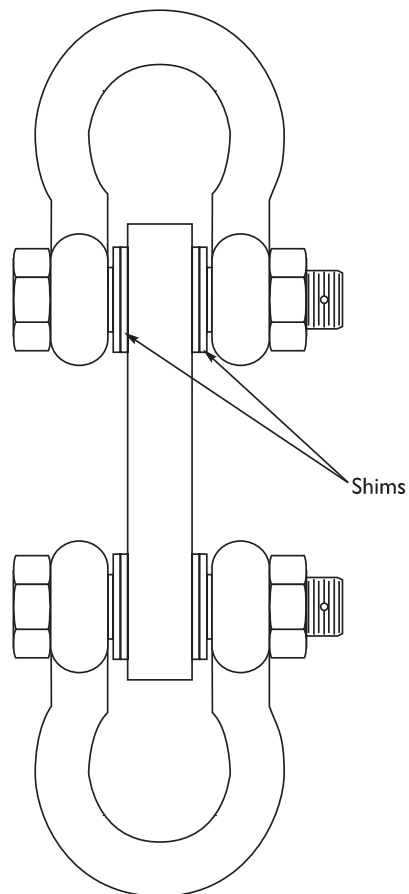
Torque and bending should be avoided. Use swivels on the lifting wire for antitorque and avoid side forces.

Certified Gear

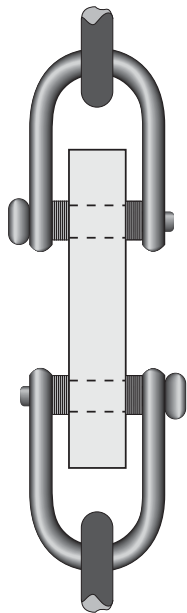
Certified shackles and lifting gear should always be used in accordance to local laws and federal legislation.

Safety

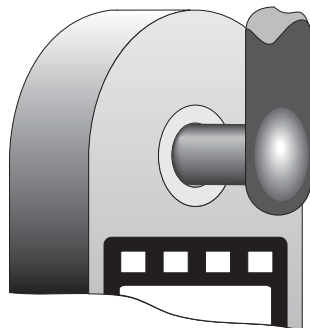
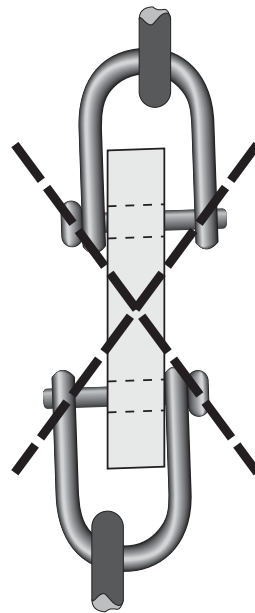
Safety is always a concern in overhead lifting and tensioning applications. To limit your liability always insist upon factory supplied shackles and pins and factory tested and certified safe optional equipment. All DILLON products are designed to meet the published Safe Working Load (SWL) and Ultimate Safety Factor (USF) standards of the United States Military.



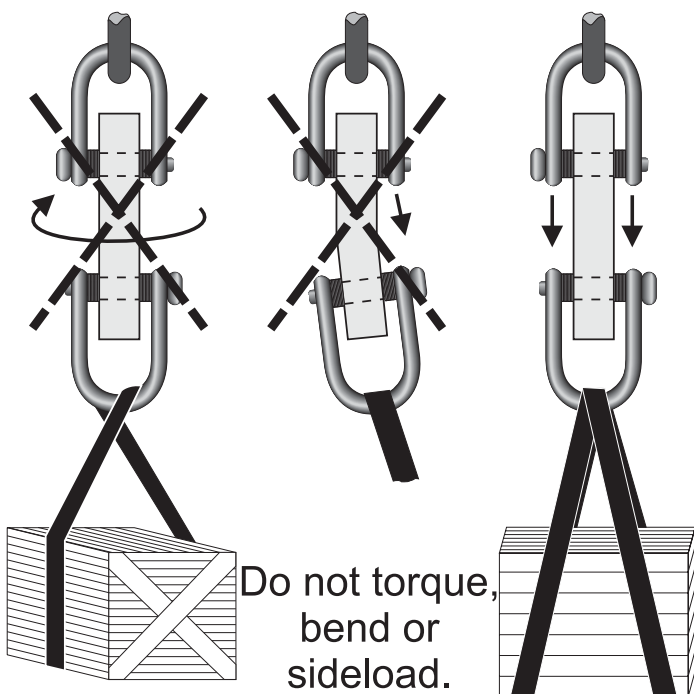
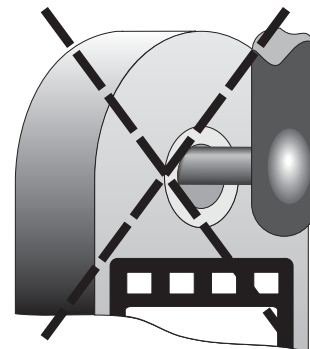
Good Force Measurement Practice



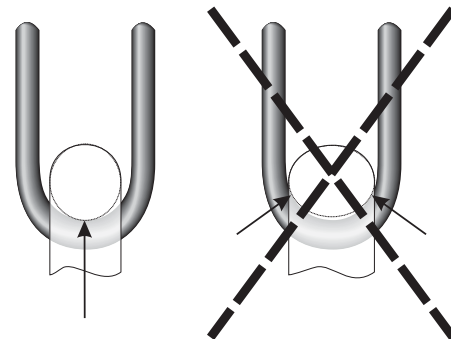
Center the load
on the shackle pin.



Use only with
a pin of the
same diameter
as the original
factory equipment.



Do not torque,
bend or
side load.



Use hardware that allows
single point attachment
and freedom of alignment.
Do not use hardware that
is oversized and restricts
self-alignment. This results in
off-axis loading.

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