WEIGHTROLLER
VANGUARD MV HI-ACCURACY

MOBILE SCALE   WVH-2000 MV
version 3.0

INSTALLATION MANUAL
rev. 3.00 (12-2013)

KEYTROLLER, LLC

TABLE OF CONTENT

**PLEASE READ THIS MANUAL
BEFORE INSTALLING THE
VANGUARD SYSTEM**

**THE VANGUARD SYSTEMS IS A 12V
SYSTEM A VOLTAGE CONVERTER
MAY BE NECESSARY**

KEYTROLLER'S mobile weighing system WEIGHTROLLER model **WVH2000 MV VANGUARD** is an electronic weighing system intended for mounting on lifting units with a hydraulic lift system. **WVH2000 MV VANGUARD** is based on a dynamic measurement of the hydraulic pressure. This method provides a much more precise weighing result compared to in line singe pressure hydraulic weighing systems because it takes much of the hydraulic pressure errors out by averaging many pressure inputs through it's bypass measuring block. Practical experiences have shown that the **WVH2000 MV VANGUARD** is very reliable, and the easy installation procedure has reduced the maintenance to an absolute minimum.

WVH2000 MV VANGUARD is connected to the hydraulic system and fits to almost any type of lifting unit. Since the sensor is mounted in the hydraulic circuit, exposed cabling is avoided. The electrical requirements are easy to accommodate, because **WVH2000 MV VANGUARD** is working with a wide range of supply voltages... from 10 to 48 VDC.
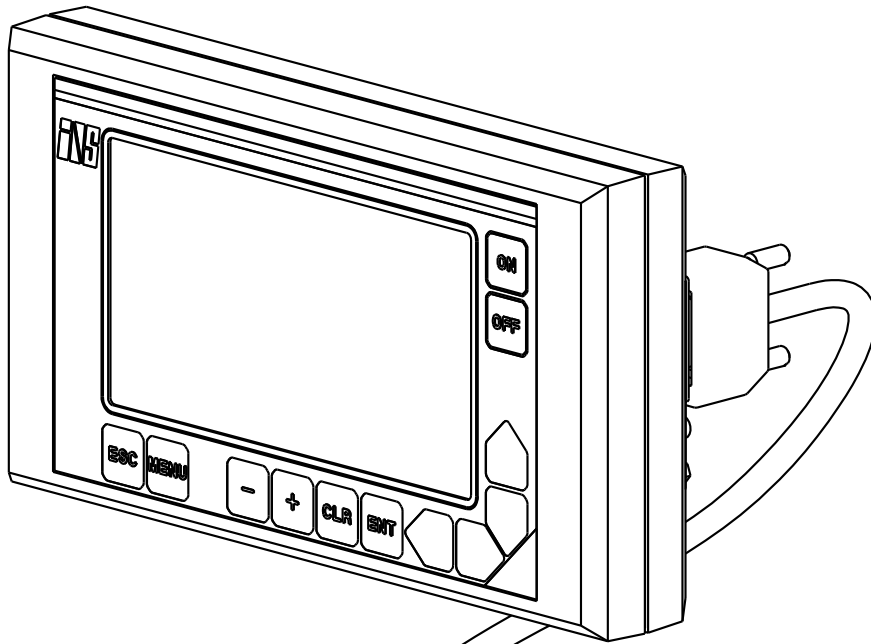
The lift scale consists of only two components... an **Indicator** and a **Measuring Block**. Operating, programming and calibration of the scales system are performed from the indicator without needs of any special tools. The Measuring Block, which has to be connected to the hydraulic system, sense the load and transmits this signal to the Indicator.

This installation manual assumes the reader has a basic knowledge of how to use the WVH2000 MV VANGUARD on a basic user level. Read the "USER´S MANUAL" for more information, of how to operate the scales system.
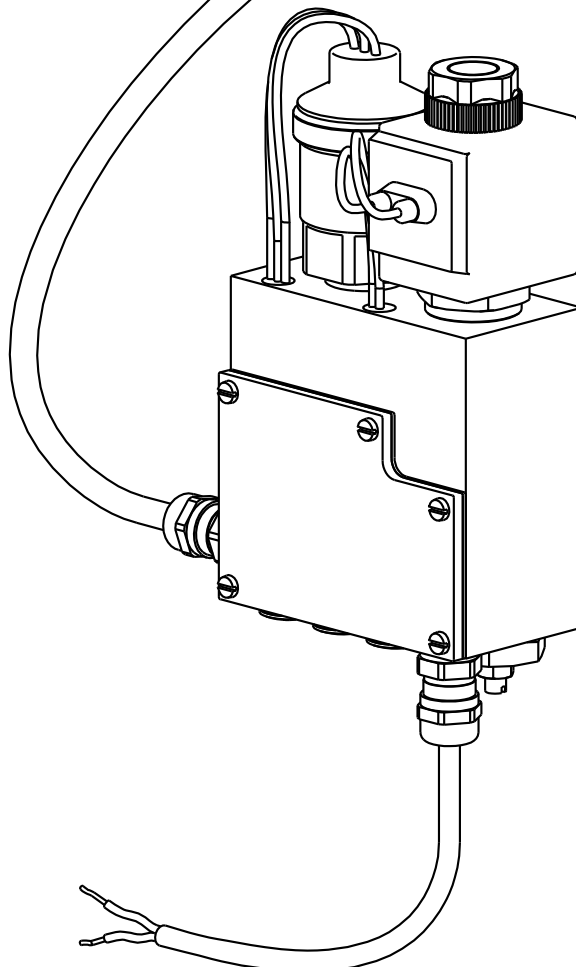
The following figures illustrate the complete weighing system... the Indicator and Measuring Block and a figure illustrating the measuring block together with the hydraulic system.
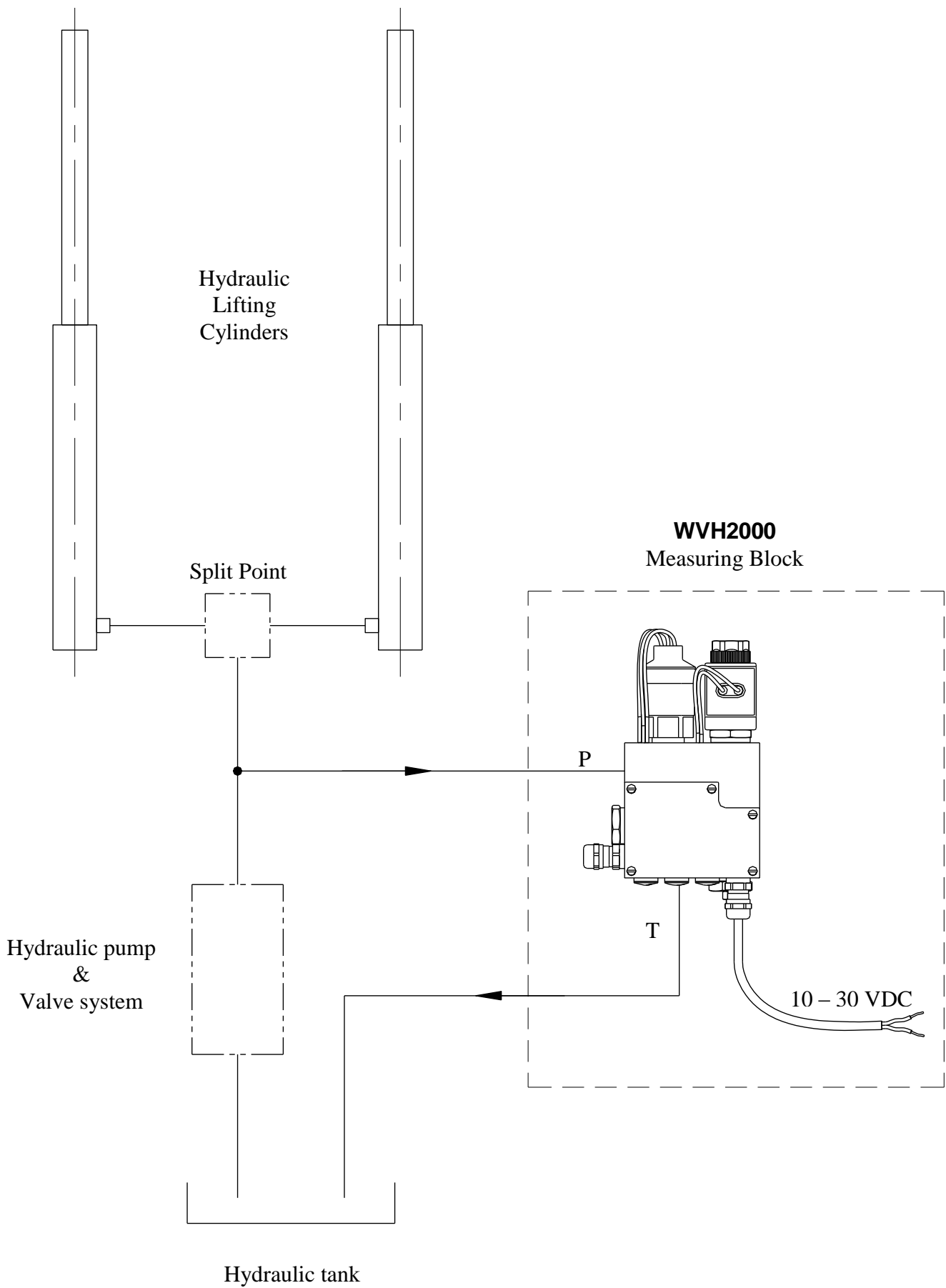
WVH2000 WEIGHING SYSTEM

Indicator

Measuring Block

Hydraulic
Lifting
Cylinders

WVH2000
Measuring Block

Split Point

P

Hydraulic pump
&
Valve system

T

10 – 30 VDC

Hydraulic tank

BEFORE INSTALLATION OF WVH2000 VANGUARD.

1 **WVH2000 MV** is a weighing indicator and does not conform to the EU-directive covering Verified Weighing Systems for trade.(**NOT** Legal for Trade) The standard version of **WVH2000 MV** can be used on lifting units with lifting capacity of up of up to 10000 pounds
Vehicle that have a LOAD CAPACITY over 10000 pounds must be equipped with the optional Heavy Duty measuring block, which can be supplied as an option. (Contact your Keytroller Rep) The **WVH2000 MV** can be installed on lifting units with capacities up to 99,9 tons. The stated weighing accuracy is based on tests performed on lifting units with standard lifting devices.

2 The lifting unit becomes part of the **WVH2000** weighing system, and therefore affects the weighing accuracy. *To obtain maximum accuracy it is recommended to check the conditions of the mechanical parts on the lifting unit. All parts must be in good working order.*

3 Determine the maximum hydraulic pressure of the lifting unit, on which the **WVH2000 MV** is to be installed, by reading the data sheet of the lifting unit or by measuring the hydraulic pressure while lifting the maximum permitted load. Most lifting units have an operating hydraulic pressure from 0 - 160bar. Therefore **WVH2000 MV** is delivered with a 160bar pressure transmitter as standard. For Higher pressures from 0 - 250bar the **OPTIONAL Heavy Duty BY-PASS** module is required.

4 Determine the electrical supply voltage of the lifting unit, on which the **WVH2000 MV** is to be installed. Lifting units typically operate with 12, 24, 36 or 48VDC. **WVH2000 MV** can as standard be connected to 12, 24, 36 and 48VDC applications. Applications **OVER 48VDC WILL DAMAGE THE VANGUARD system.**

5 The electrical supply voltage, must never change more than +/- 10% while the WVH2000 is running. If the battery/power supply on the lifting unit is not able to meet this requirement, it will cause a malfunction and loss of parameters in the display. The display will then need to be reset, and the calibration parameters will need to be re-programmed into the system menu's.

6   **If you are not sure about the voltage please contact Keytroller Tech Support before proceeding as serious damage can result to the WVH2000 Vanguard weighing system.**

INSTALLATION OF WVH2000.

1   Find a place on the lifting unit to mount the "Measuring Block", considering the pressure pipe connected to the measuring blocks P-inlet should be kept as short as possible. Remember that you must be able to connect the hydraulic pipes from two sides. Ensure that it is possible to adjust the "Flow Control" (Nr. 5 page 8)

2   Before the hydraulic installation is commenced, it is very important to bear the following instructions in mind:
    To avoid problems in the hydraulic system of the lifting unit, it is very important that all hydraulic components are kept clean. Further more all recommendations for working with hydraulic systems must be kept. **The pipes/hoses used for the installation should as much as possible be the same size as the existing ones already installed on the lifting unit.** It should be noted, that the maximum capacity of flow through the measuring block is 4 Gallons per minute. We recommend that the flow speed in the pipes/hoses does not exceed 10 feet per second.

3   Make a hydraulic pipe or hose fitting in length from the P-inlet of "Measuring Block" to the hydraulic pressure pipe on the lifting unit. (as close to the split point as possible) SEE DIAGRAM pg 5

4   Make a hydraulic pipe or hose fitting in length from the T-outlet of "Measuring Block" directly to the hydraulic tank on the lifting unit. **It is important that the return pipe is fitted directly to the tank, since fitting it to the existing return system can cause inaccuracies when weighing.**

5   Mount the "Indicator" an appropriate place and in easy reach of the operator. The bracket used for mounting the "indicator" has a thread in one side. Make sure the thread is in the same side as the plug (the side to the right), otherwise the bolt holding the indicator will conflict with the plug on the rear side of the **WVH2000 MV**. Connect the electrical cable from the measuring block in the rear side of **WVH2000 MV** (plug D-SUB9). Should it be necessary to disconnect the cable from the measuring block in order to lead the cable to the indicator, the electrical installation can be seen on the "EL-diagram" on page 10.

6   **WVH2000 MV** is delivered for a 12 , 24, 36 and 48VDC voltage supply. Connect the power supply cable to a power supply on the lifting unit using a fuse of maximum 5 Amp between the cable and the power supply outlet

7   Ensure that all hydraulic and electrical mountings are OK and in accordance with the instructions in this manual.

8   Turn on the **WVH2000 MV** and the "main screen" should appear. If everything looks correct the **WVH2000 MV** is now ready to be programmed and calibrated. If the system does NOT display the "main screen" then disconnect the power supply immediately until the problem has been located and solved.
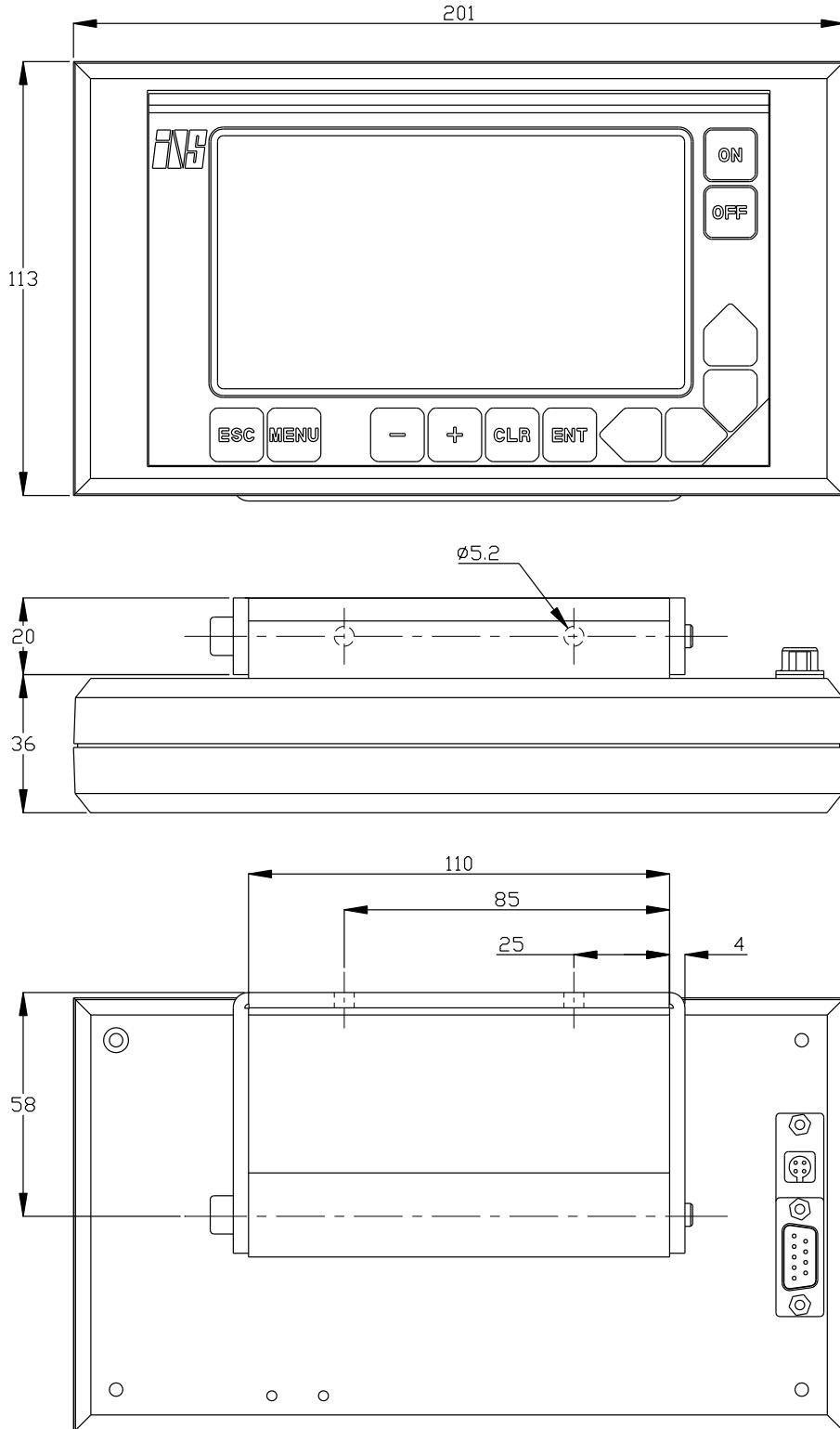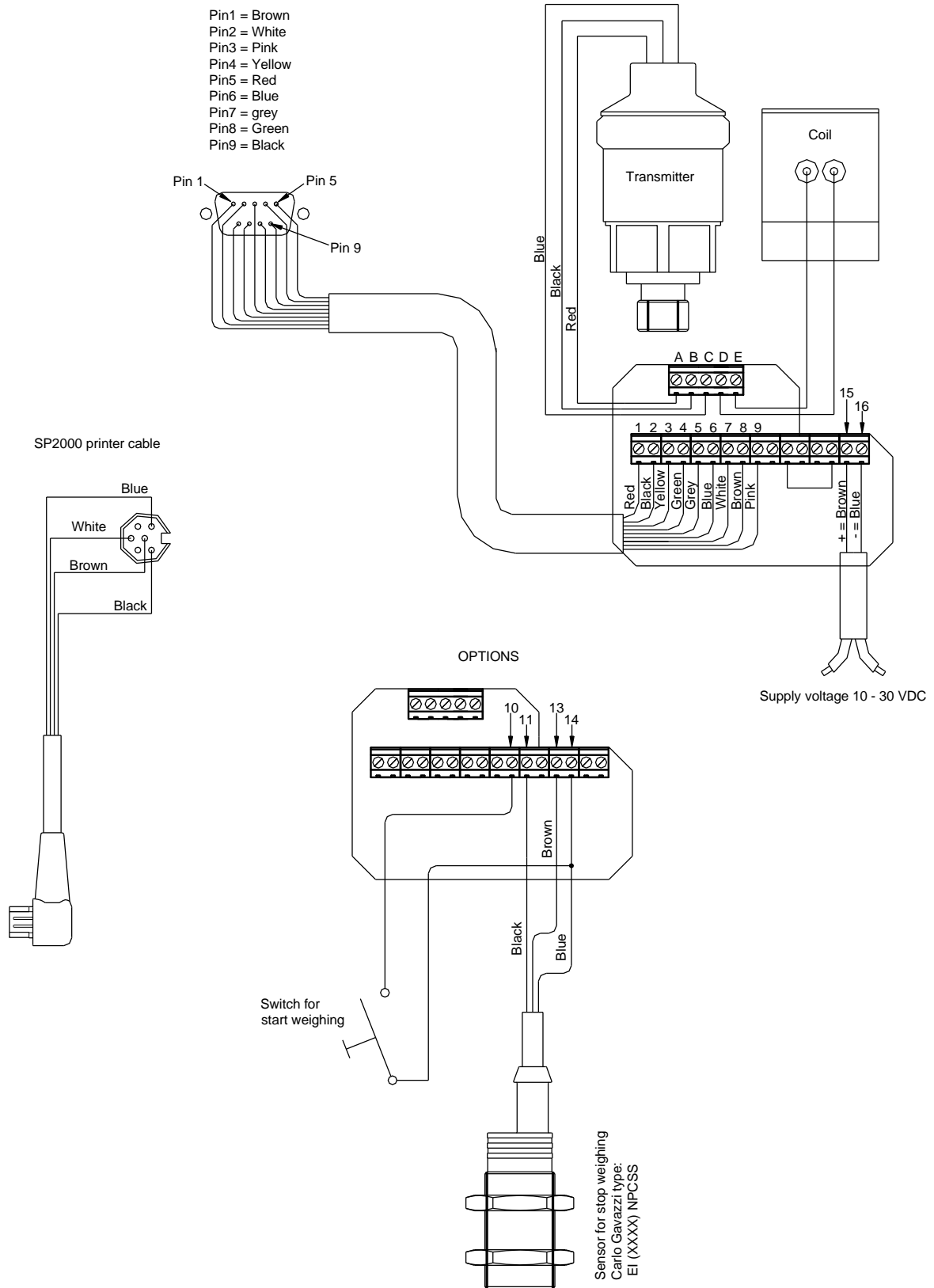
MEASURING BLOCK & DIMENSIONS
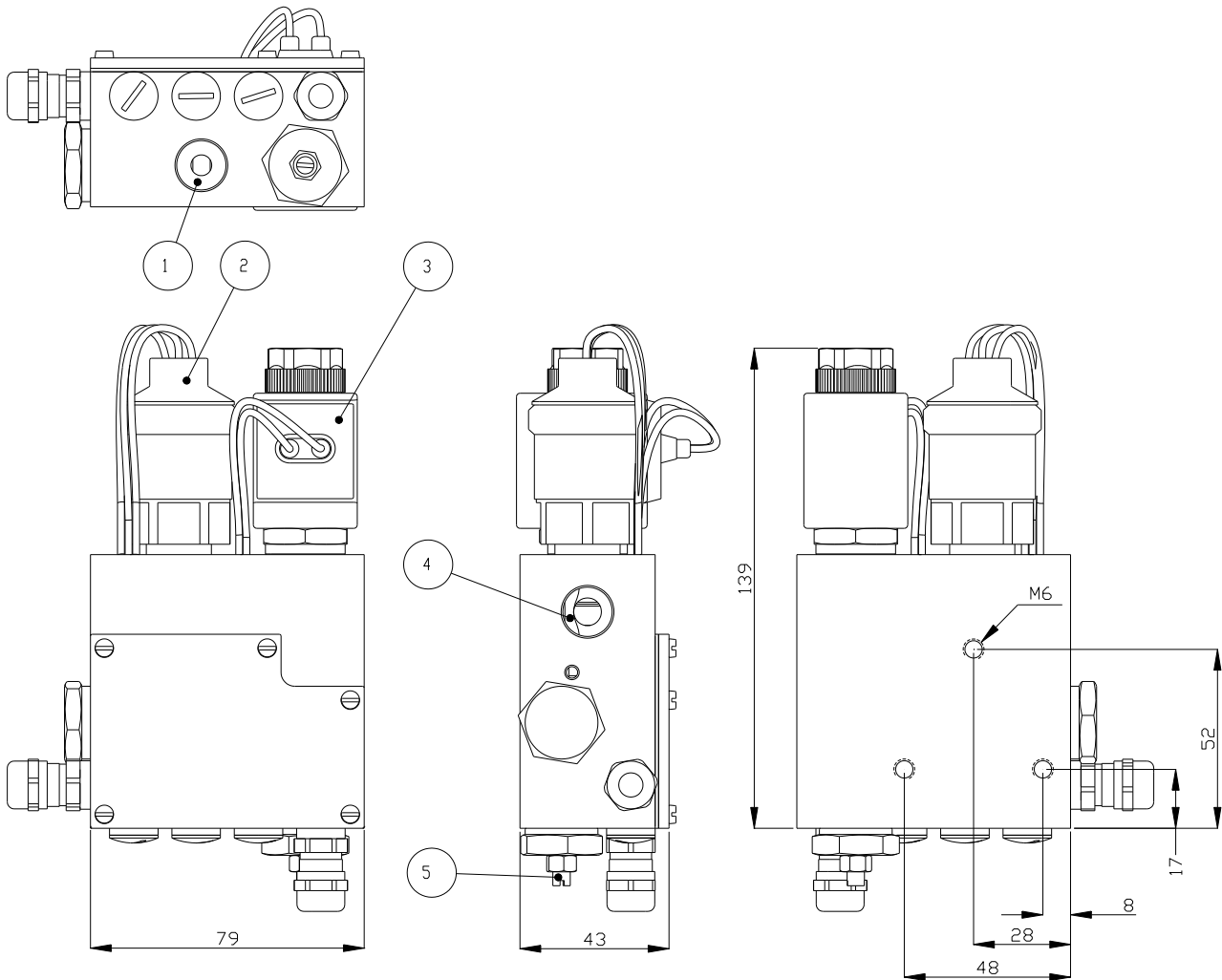
1. **T = Return pipe for hydraulic tank 3/8" BSP**
2. **Pressure transmitter**
3. **Valve**
4. **P = Input for pressure pipe 3/8"BSP**
5. **Flow control**

WVH2000 INDICATOR & DIMENSIONS

EL-DIAGRAM

Pin1 = Brown
Pin2 = White
Pin3 = Pink
Pin4 = Yellow
Pin5 = Red
Pin6 = Blue
Pin7 = grey
Pin8 = Green
Pin9 = Black

Pin 1   Pin 5

Pin 9

Transmitter

Coil

Blue
Black
Red

A B C D E

1 2 3 4 5 6 7 8 9

Red
Black
Yellow
Green
Grey
Blue
White
Brown
Pink

15   16

+ = Brown
- = Blue

Supply voltage 10 - 30 VDC

SP2000 printer cable

Blue

White

Brown

Black

OPTIONS

10   13
11   14

Brown

Black

Blue

Switch for
start weighing

Sensor for stop weighing
Carlo Gavazzi type:
EI (XXXX) NPCSS

MENU'S

WVH2000 MV is developed to fit many different types of lifting units, and can be configured with individual data for each individual type. After calibration it is strongly recommended to fill out the **"Calibration Sheet"** attached to the USER´S MANUAL, to record the parameters in case a potential malfunction should occur in the future.

In the following instructions on programming it will be explained how simple it is to configure the system.

In order to be able to perform changes in all the menu's, the **WVH2000 MV** must be turned off. To enter the programming and parameter menus the **WVH2000 MV** is turned back on by pressing the ON button. **Immediately after pressing the ON button, press** [MENU] **-** [←] **-** [+] **, (in that order). It is important the combination has been pressed and ended, within a few seconds after pressing ON.**

NOTE: This is the only code to enter the programming function and should not be given to operators.

It is now possible to program the parameters in all of the menu's. By pressing [MENU] you enter menu 1 of 6. The top right corner shows which menu is visible. It is possible to leaf through the menu's by pressing [+] and [−].

Until the **WVH2000 MV** is turned off, it is possible to perform parameter changes in all menu's. If the indicator is turned off, the procedure above must be repeated when turned ON again in order to change any of the programming or parameters except Date & Time.

A parameter is selected by pointing it out with the cursor using the blue up/down or left/right arrows followed by pressing **[ENT]**. For example, select **0-CALIBR. MODE** by using the arrows and then press the **[ENT]** button. A numerical keyboard pops up on the screen and the value in **0-CALIBR. MODE** will flash. It is now possible to enter a new value, using the numerical keyboard. In order to clear an existing value simply press **[CLR]**. The entry of data is finally confirmed by pressing **[ENT]** on the **[OK]**-button. If the **[ESC]** button is pushed instead of the **[OK]** button, the data entry is cancelled.

When a value has been accepted by **[OK]** button, **WVH2000 MV** automatically steps to the next parameter. The rest of the parameters are programmed in the same way, as shown above.

When all the relevant parameters are programmed, press **[ESC]** twice in order to return to the main screen.

Push [ESC] [ESC] and the main screen will appear.

The fundamental method of programming has now been shown, and an explanation of each parameter will be provided in the next pages.
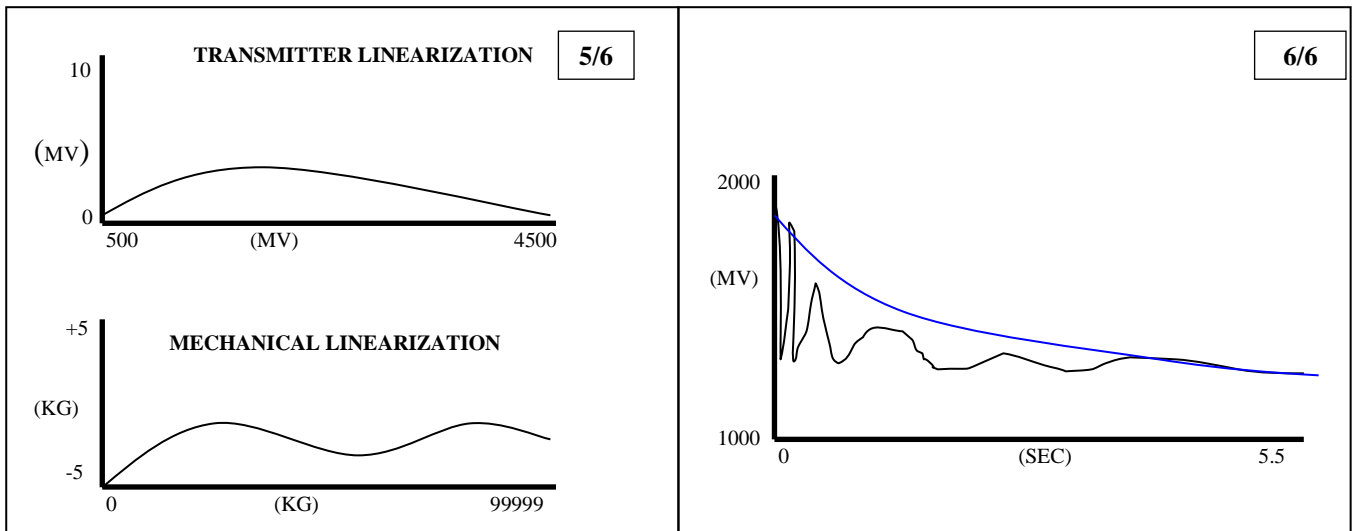
MENU'S

VER. 2.26 **TIME & DATE**

YEAR	:	2004
MONT	:	3
DATE	:	8
HOUR	:	14
MINUT	:	40
SECOND	:	36

CALIBRATION

TRANSM. – 0 MV	:	500	CALIBR. LOAD	:	1000
0-CALIBR. MV	:	1000	CALIBR. COUNT	:	0
OUTPUT MV/TON	:	1000.0	MECH. LIN. UNIT	:	0
UNIT KG, LB	:	0	DISPLAY COLOUR:		0
DIVISION	:	1			
MIN LOAD	:	50			
MAX LOAD	:	99999			
TIME CONSTANT	:	0,4			
MEASURING TIME:		5,0			
0 – CALIBR. MODE:		0			
WEIGHING MODE :		1			

TRANSMITTER LINEARITY

REFERENCE % 0 :	0	ACTUAL MV 0	:	500
REFERENCE % 1 :	25	ACTUAL MV 1	:	1500
REFERENCE % 2 :	50	ACTUAL MV 2	:	2500
REFERENCE % 3 :	75	ACTUAL MV 3	:	3500
REFERENCE % 4 :	100	ACTUAL MV 4	:	4500

MECHANICAL LINEARITY

REFERENCE LOAD 0:	0	ACTUAL LOAD 0:	0
REFERENCE LOAD 1:	0	ACTUAL LOAD 1:	0
REFERENCE LOAD 2:	0	ACTUAL LOAD 2:	0
REFERENCE LOAD 3:	0	ACTUAL LOAD 3:	0
REFERENCE LOAD 4:	99999	ACTUAL LOAD 4 :	99999

TRANSMITTER LINEARIZATION

MECHANICAL LINEARIZATION

PARAMETER EXPLANATION

MENU 1 :

YEAR	States the year
MONTH	States the month
DATE	States the date
HOUR	States the hour from 1 to 24
MINUTE	States the minute.
SECOND	States the second. For indicators without real time clock, the parameter is set to 60. Then all the times/dates in the display is set to 0.

MENU 2

TRANSM. – 0 MV   The value of the output, measured in mill volt, the pressure transmitter has when it is completely pressure less. This parameter is only used when calibrating or linearizating a new pressure transmitter.

DO NOT CHANGE THIS PARAMETER

0-CALIBR. MV   The output voltage, from the pressure transmitter without load. This value becomes automatically programmed, when a 0-Calibration of the scale is performed. (Unless locked in the "0-CALIBR. MODE")

DO NOT CHANGE THIS PARAMETER

OUTPUT MV/TON   The increase of the pressure transmitter output voltage each time the load increases with 1 ton. This parameter is programmed when calibrating the system. The formula used to calibrate is:

$$\frac{(\text{Weight shown in Display} * \text{Present Output MV/Ton})}{\text{Actual weight of load}} = \text{New Output MV/ton}$$

DO NOT CHANGE THIS PARAMETER

UNIT KG, LB   The weighing system can show the weighing results in kilograms or pounds. When value **0** is chosen it will *weigh in kilograms*. When value **1** is chosen it will *weigh in pounds*.

DIVISION   This parameter determines the displayed graduation in kg or pounds. The shown value will be dividable with the chosen value. The division has to be one of the following values: 1, 2, 5, 10, 20, 50, 100, 200, 500,1000. **This parameter should not be changed until after calibration.**

MIN LOAD   The minimum load the system can weigh. This value is normally not below 10 divisions. This parameter is only used as information for the user. **MIN LOAD MUST set at "0" while calibrating the system. This can be changed to customer spec. after calibration is completed.**

MAX LOAD   The maximum load the system must weigh. A weighing with a load exceeding this value will be aborted, and the displays will show horizontal lines as an indication of overload. The "MAX LOAD" parameter can also be used where a reduction in the weighing capacity is wanted even though the lifting unit has a higher capacity. This is done when a higher accuracy is wanted, since the accuracy of the system is related to the capacity of the system.

MAX LOAD MUST be set at 99999.0 Until after calibration. This can be set to customer spec. after calibration is completed.

TIME CONSTANT   This parameter is used for the technical calculations in the software. The "time constant" is as standard 0,4 sec. The "time constant" is a part of the software filter. This determines the frequency limit of the ingoing signal. By increasing the "time constant", a lower frequency limit is achieved and will result in an increased damp of the ingoing signal.
DO NOT CHANGE THIS PARAMETER

MEASURING TIME   This parameter determines for how long time the measuring will take place during the weighing process. "MEASURING TIME" is determined in seconds with one decimal point, and must not be less than 12 x "TIME CONSTANT".
DO NOT CHANGE THIS PARAMETER

0 – CALIBR. MODE   If the value is "0", there are no restrictions for performing a 0-calibration. If the value is "1", it is only possible to do a cero-calibration if the change in mill volt is smaller than 10 divisions. If the value is set to "2", it is not possible to 0-calibrate.

WEIGHING MODE   This parameter determines whether it is possible to execute both sequence weighing and normal weighing or just one of them. As standard this parameter is 1, which only makes it possible to execute normal weighing. If the parameter is changed to 0, it is possible to do both. If the parameter is changed to 2, it is only possible to execute sequence weighing.

CALIBR. LOAD   When the **WVH2000** has to be calibrated it is done automatically by inserting the weight of the reference load in this parameter. **The reference load MUST BE of a KNOW EXACT WEIGHT !! The accuracy of the systems depends on this calibration factor.**

CALIBR. COUNT   For automatic calibration of the **WVH2000**, this parameter is used for entering how many times the load should be weighed. It is recommended that the Calibration load be weighed a minimum of "3" times. the number "3" is entered. If calibration is desired by the average of 5 results, the number "5" is entered. The average output of the weighing will determine the new "OUTPUT MV/TON". (this parameter will change automatically according to the information given the **WVH2000**)

MECH. LIN. UNIT   The value determines whether the linearization is done in kilos our pounds. The value 0 is used for kilos, and the value 1 is used for pounds. In most cases this parameter is not necessary. **DO**

NOT CHANGE THIS PARAMETER CALL TECH SUPPORT BEFORE CHANGING THIS PARAMETER. 813-877-4500

DISPLAY COLOR   As standard this parameter is 0. By changing the parameter to 1, the display is inverted. This means that as standard the writing on the screen is black on white background. By inverting the display, the writing will be white on a black background.

MENU 3

TRANSMITTER LINEARITY:

This menu is used by the manufacturer for a possible linearization of the pressure transmitter. If a linearized pressure transmitter is replaced, the new values must be entered in this menu.

DO NOT CHANGE THESE PARAMETERS. These are used by the manufacture only.

MENU 4

MECHANICAL LINEARITY

This menu is used if the system is not linear. If the system is accurate in both the high and low end of the capacity, but is inaccurate at the middle, this menu is used to compensate. By entering the value shown in the display in the left column, and the actual weight of the reference load in the right column, the system will automatically compensate the linearity. For optimal use of this menu, it is recommended to test the system with loads covering the whole capacity from top to bottom, and then only compensate the values where the system is most incorrect.

DO NOT CHANGE THESE PARAMETERS without contacting Tech Support. 813-877-4500

MENU 5

LINEARIZATION   This menu shows a visual graph of the values entered in menu 3 and 4. If no changes have been made, the graphs will not be visible. If a printer is installed to the system, the graphs can be printed out by pressing 🔲, when menu 5 is visible in the display.

MENU 6

FILTER IN/OUTPUT

This menu shows a visual graph of the input from the pressure transmitter during the last weighing. By pressing ⬡, the output after the software filter will occur. This menu is used for finding possible reasons for inaccurate weighing like electric pollution, problems with the moving parts etc. If a printer is installed to the system, the graph can be printed out by pressing 🔲MENU, when the menu is visible in the display.

## THE CALIBRATION OF WVH2000 VANGUARD.

BASIC RULES

During the calibration it is important to follow these basic rules. This will increase the accuracy of the system.

1   Place a **"weighing mark"** on the lifting unit. Place a mark on Mast and Carriage. This mark must be placed in such a way, that regardless of who is operating the lifting unit, the load will always be lifted to the same place and height every time. Make sure to place the weighing mark high enough, so that the "lowering" will stop before the load touches the ground (minimum 16-18 inches above the ground Slightly higher for pneumatic units). The weighing mark can be made by using paint, welding etc.

2   **During calibration the lifting unit must be located on a firm and level surface.**

3   *The weight of the reference load must be accurate!!!!!*
It is recommended to do a check weighing of the reference load just before calibration on an approved weighing system. The reference load used for calibration should be equal to **at least half of the maximum capacity** of the system for highest accuracy. The system can be calibrated with any weight over 500 lbs. It would be a good idea to have multiple reference loads available to check the accuracy of the weighing system after calibration.

4   During calibration the load must be placed centrally on the lifting unit, with respect to position and gravity. The load must be completely stable during the calibration process. When calibrating a forklift truck the mast must be vertical. **Every weighed load must be completely lowered to the floor before a new weighing can take place. The same goes for zero-calibrations. These precautions are vital for an optimal calibration.**

5   **The "DIVISION" parameter should be 1 during calibration.** This is to find even the smallest differences in the accuracy and repetition. After the calibration, change the "DIVISION" to the number suitable for the accuracy of the system. (For more information read DIVISION in chapter 3 "Programming" page 13)

6   **The calibration process should not begin before the lifting unit and hydraulic oil have reached normal working temperature. The weighing system takes about 5 minutes to reach working temperature.**

7   During waiting time for the system to reach the working temperature, execute weighing 5-10 times in order to expel air out of the system.

CALIBRATION

1   Switch ON **WVH2000**, followed by pressing [MENU] - [—] - [+]. (In that order) The indicator will start up, and it is now possible to make changes in all menu's. It is important that pressing the combination is ended within 2-3 seconds after pressing ON.

2   Lift up to the weighing mark. Press [ENT] and observe the lifting device lowering 16-18 inches (forks should not drop more than 10 inches) over 5 seconds. It is important the lowering is stable and that it is lowering with the same speed from start to finish. Adjust the flow control on the measuring block to adjust the lowering speed. Repeat procedure until a satisfactory lowering speed is achieved. **Make certain the lowering speed is the same with or without a heavy load. (At this point the result shown in the indicator is of no importance)**

3   Lift the empty forks up to the weighing mark. Execute 0-calibration. (Choose function symbol F4-2 and press [ENT], read the "User's Manual" for how to do a 0-calibration)
Read 0 in the display

4   Press [MENU] and use the [+] -button to find menu 2:
Read data : O-CALIBR MV (write it down)
Press [ESC] until the normal screen appears.
Repeat step 3 and 4 a couple of times. It is important the value in "O-CALIBR MV" is stable. It must not change more than 3-5 MV. Remember to lower the forks all the way down before lifting them up to the weighing mark to making a new 0-calibration. When a stable value has been found continue to step 5.

5   Access the menu and enter the weight of the reference load to be used for calibration in the parameter "CALIBR. LOAD". Then enter 3 in the parameter "CALIBR. COUNT". Press [ESC] twice to return to normal screen.

6   Lift the reference load to the weighing mark and press [ENT]

When the lowering stops, lower the load to the floor. (The weight shown is of no importance at this time).
Raise the load to the weighing mark a second time and press [ENT}
When the lowering stops lower the load to the floor

Raise the load to the weighing mark a third time and press [ENT}
The system should now display the weight of the calibration load. The system is now calibrated.

7   Check the results a couple of times by weighing the calibration load.

8   Once calibration is over, check the linearity by weighing smaller reference loads. Remember that reference loads MUST BE loads of exact known weights.

9   When the calibration is finished a suitable "DIVISION" should be entered. It is possible to choose from: 1, 2, 5, 10, 20, 50, 100, 200, 500.

10   Finally the MAX and MIN LOAD should be entered. The "MAX LOAD" is the capacity of the lifting unit.

When calibration and all parameters have been set press [ESC] twice to return to the main screen. Turn the **WVH2000 MV** off for 10 seconds.
Turn the **WVH2000 MV** back on and you are ready to start weighing.

PLEASE call our Technical Assistance Desk at 813-877-4500 if there are any questions