RFS 4
Technical Manual

Program: G4MI_101.0.119.0

Roll Force Measurement System

Content

This description is valid for:

G4 Multi Channel Force Instrument with application program **101.0.119.0**

See also the following descriptions

G4 Multi Channel Force Instrument Program version 101.0.0.0
Technical Manual PM/DT/HE (600896)
If these descriptions in any case are contradictory, the description in this manual is valid.

1. INTRODUCTION

The RFS 4 is a purpose-built **ROLL FORCE MEASUREMENT SYSTEM** specifically designed for use on both new and existing rolling mills, the RFS 4 system provides the mill operator with continuous monitoring and display of roll separating force and differential forces (balance). In addition, the system automatically cancels temperature induced drift in the extensometers during the period that the mill is empty and provides local and remote indications that metal is in the mill or that the mill is overloaded. Signal outputs representing measurements being taken by the system are supplied for operation of remote indicators or for use by external control systems. The system utilises the **BLH / Nobel Weighing Systems** high performance Multi Channel Force Instrument G4 and Model E-4 Extensometers. The G4 instrument provides the excitation for the Extensometers and converts the low-level analogue extensometer signals to high resolution digital signals. The instrument utilises parameter-controlled calculations to produce internal measurement values. The instrument has the ability to produce the DRIVE, WORK, SUM and DIFFERENCE values that can be converted to a current or voltage analogue signals at the analogue outputs, or be communicated via serial communication or fieldbus. Trip levels can be configured to activate digital outputs at any pre-set value and referenced to any of the computed values.

All input signals, output signals, and the power supply are galvanic isolated from each other. The RFS 4 instrument is normally supplied mounted in a wall mounted enclosure RITTAL type AE1050 500 with a plexi glass door, and with terminals inside, for ease of site wiring but can be supplied in various cabinet configurations to meet customer requirements. See standard configuration drawings (Appendix 3 - 6) or customized drawings for details.

2. SYSTEM DESCRIPTION

The RFS 4 system consists of either 2 or 4 extensometers connected via either 2 or 4 junction boxes to the RFS 4 unit. Special high temperature cable is utilised to wire the extensometers to the junction box and general-purpose industrial (e.g. FKAR PG 4x2x0,5) cable from the junction box to the instrument.

⚠️	The **HSWF 2S** High Speed Weight/Force input module is a special version that allows an input range of +/-45 mV/V. The normal range of a HSWF 2 is +/- 4,5 mV/V so standard HSWF 2 units **must not** be used to replace faulty units.

The G4 two- or four--channels Function Block has all the force values to enable it to show the four computed values WORK (Output 1), DRIVE (Output 2), SUM and DIFFERENCE. Each value can be configured to be output via an analogue port either
0 -10v or 4-20 ma to represent any of the computed values. All values can also be communicated via serial communication or fieldbus (modbusTCP, Profibus or Devicenet).

System with 2 extensometers
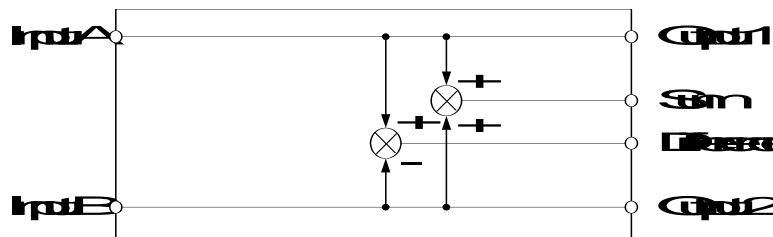
Two Channel Function block, Force mode

System with 4 extensometers

Four Channel Function block, Force mode

Input error functionality

If one extensometer is broken the corresponding input will report an error and the display will show the error indication and no calculated values. In the communication, the error code register for the function block will indicate the error and the status register for the function block will indicated which input that has the initial error.
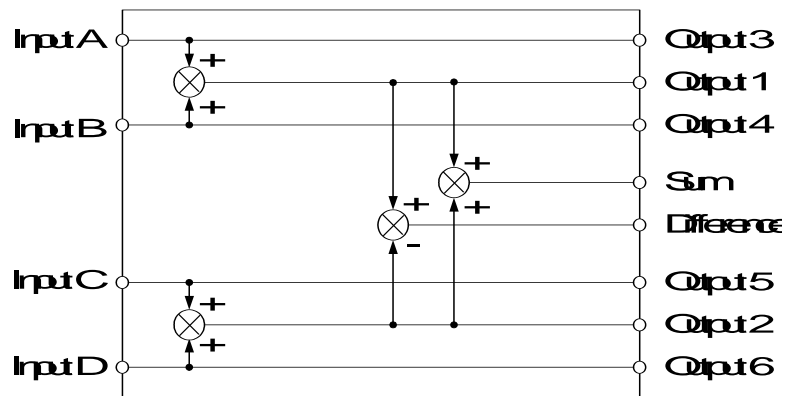
In order to make it possible to still run the mill, the value that should be produced by the faulty extensometer is replaced by the value of 'nearest' (hopefully working) extensometer.

In the communication the replaced (simulated) values can be read.
Analog outputs will go to zero, and level supervision outputs will be deactivated.

Examples.

Four channel function block.
If input C is faulty the value is replaced by input D which means that input C and output 5 will have the same value as input D and output 6, and the value of output 2 will in fact be two times
input D value.

Two channel function block.
If input A is faulty the value is replaced by input B which means that input A and output 1 will have the same value as input B and output 2, and the value of output Sum will in fact be two times input B value (the value of output Difference will be 0).

3. INSTALLATIONS OF EXTENSOMETERS

EXTENSOMETER INSTALLATION

The Type E-4 Extensometers and associated enclosures, Figure 3-1, are basic elements in the Roll Force Measuring System. The extensometer is a strain-sensing device with semiconductor strain gauges mounted in Wheatstone Bridge configuration. Roll separating forces are measured by attaching the extensometers to bolts welded to the mill posts and monitoring the extensometer output measure roll separating forces, which vary in proportion to applied stress. The following instructions outline the step-by-step procedure for properly installing the extensometers and associated enclosures on the mill posts.
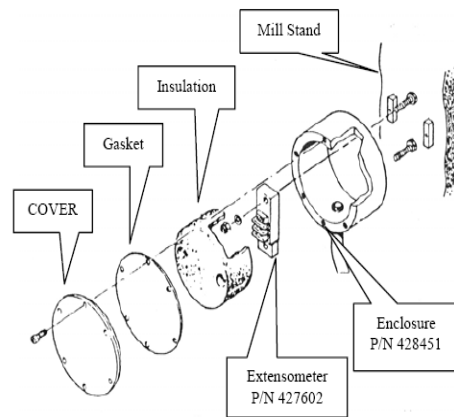
Fig 3.1 Exploded View Of Extensometer And Enclosure Assembly

Equipment Requirements.

In addition to the extensometer assemblies and welding equipment, installation requires the following equipment. Note that the items a to d are included in BLH installation kit P/N 429662. A full list of parts is shown in chapter 10.

a. Clamp Tool, P/N 447088

b. Two Bolt Protectors, P/N 429661

c. Bolt Welding Fixture, P/N 258912

d. Two Plain Hex Nuts 1/2 -13, P/N 123250

e. Small spirit level.

f. Torque Wrench, capable of 800 lb-inch (67 ft lb)

g. 3/4 A/F socket spanner.

h. Two nyloc hex nuts 1/2-13

i. Two plain washers 1/2 x 7/8 x 1/32

SELECTING EXTENSOMETER LOCATIONS

The extensometers can be installed anywhere along the vertical posts of the mill stand, see fig 3-2. For most installations the highest possible location is best. Areas chosen for the installation should be free of any restrictions, such as nearby piping, cables, shafting etc and should have a relatively uniform cross section. Areas to be avoided, if possible, are those adjacent to ribbing or through holes, particularly large holes. Once the area is selected, check that the corresponding areas on the opposite post are available for installation. This is an important consideration since the installation of the extensometers at the same height is critical to accurate stress measurement. In selecting the installation areas, allow sufficient space for the extensometer enclosures plus room for the welding operation.

Fig 3.2 Extensometer Location
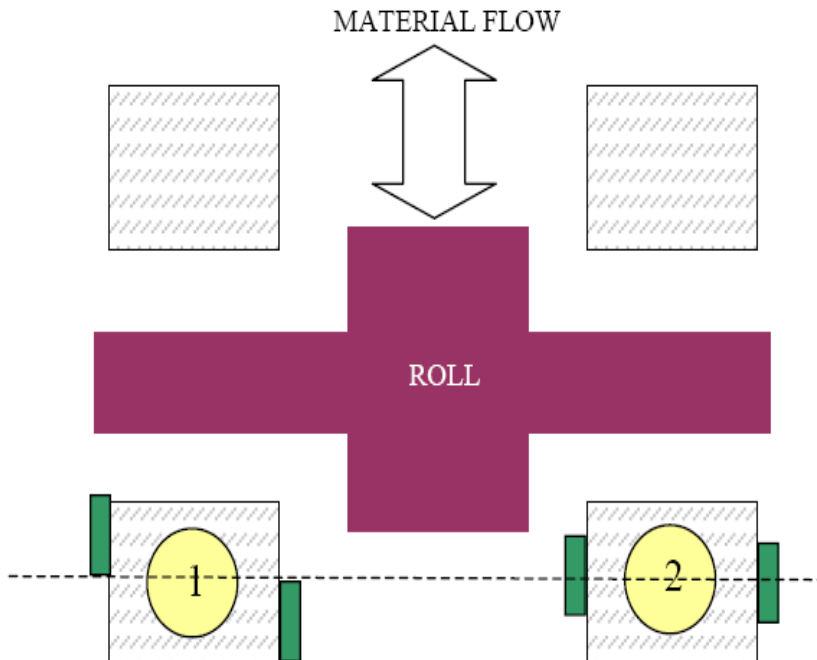
Figure 3.3 Permissible locations of extensometers:

1. Offset an equal but opposite amount from post centre line

2. On the centre line.

Two extensometers are required on each post as shown in fig 3-3. The inside and outside surfaces of the posts should be marked to show the height and centre line at which the extensometers are to be placed. Ideally, the extensometers will be placed on a line intersecting the centreline of the posts as shown at post 2 in figure 3-3, which is a view looking down on the four posts of the mill. If restrictions are present which cannot be avoided, the extensometers can be offset from the centreline as shown on post 1. Offsets of mating extensometers should be equal and opposite to ensure that bending forces are cancelled.

Upon completion of the selection and marking of the post sections where the extensometers are to be installed, measure the posts to determine the cross-sectional area at the height reference lines.

⚠ **Note these measurements for calculations later on.**

SURFACE PREPARATION

 Determine the locations on the mill stand where the extensometers are to be mounted. Clean the surface area for welding. Remove any protrusions with a hand grinder so that the surfaces are as smooth and flat as possible. Avoid any areas with pit holes.

EXTENSOMETER MOUNTING BOLT INSTALLATION

The extensometer is mounted using the bolt welding fixture and clamp tool, first weld the bolts in place, ensuring correct alignment of bolts.
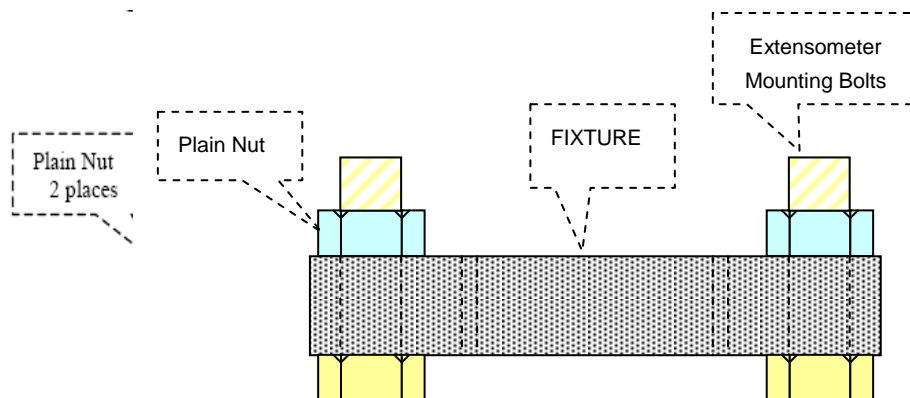
Fig 3.4 Mounting Bolts
Installed in Mounting Fixture

a) Refer to figure 3-4. Assemble the two special bolts (P/N 428838) supplied to the fixture (P/N 258912) with the two plain half-inch nuts and tighten with a spanner.
b) Refer to figure 3-5. Hand tighten the two 'A' thumbscrews to secure the tack pads to the clamp tool P/N 447088.
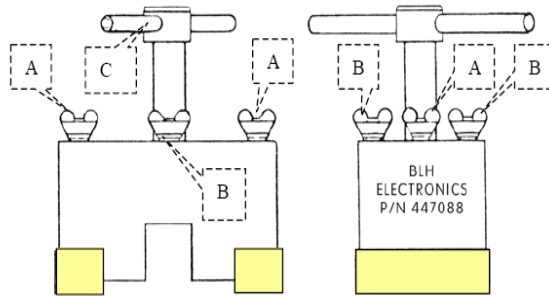
Fig 3.5 Tack Pads Attached to Clamp Tool

c) Retract clamp screw 'C' of the clamp tool until the end is flush with the slot.
d) Attach mounting bolt/welding fixture assembly, step a) to the clamp tool with the thumbscrews 'B' as shown in figure 2-6. **Tighten by hand**.
e) Place clamp tool assembly at the selected location. Use a small spirit level to orientate the fixture to ensure extensometer will be vertical and, while applying heavy hand pressure to maintain position, tack weld the two pads as shown in figure 3-7.
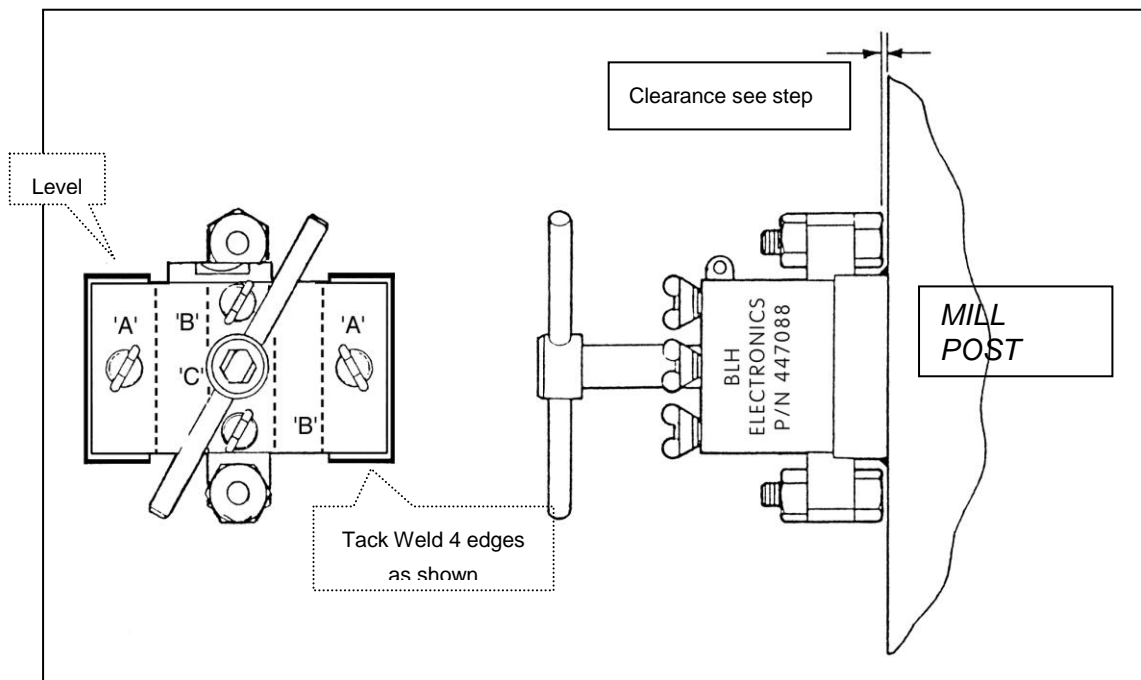
NOTE: The two clamp tack pads can be left on the mill posts and will not interfere with installation or performance of the extensometers. Additional tack pads are supplied for installing the remaining extensometers

Fig 3.7 Tack weld Locations

f) Loosen the two 'B' thumbscrews until free of the welding fixture and then tighten clamp screw 'C' firmly to place the heads of the extensometer mounting bolts against the mill posts. Weld as much of the exposed portion of the bolt heads as possible.
g) Loosen clamp screw 'C', then loosen the two 'A' thumbscrews until free of the tack pads. Remove the clamp tool.
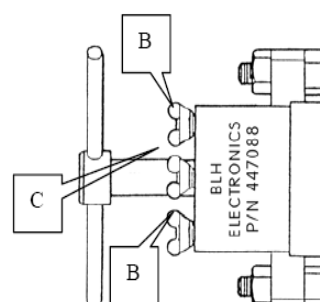
Fig 3.6 Weld Fixture Installed in Clamp Tool

h) Remove the two half-inch nuts from the mounting bolts, then take off the welding fixture.

> **NOTES**:
> 1. If the welding fixture is difficult to remove, install two 5/16-18 x 3 inch cap screws in the weld fixture and tighten the screws to drive the fixture off the welded bolts.
> 2. **DO NOT USE EXCESSIVE FORCE**.
> 3. Tighten the screws evenly so that the bolts will remain parallel.

i) Screw the bolt protectors, fig 3-8, on to the bolts and complete bolt installation by welding completely around the heads.
j) Allow the bolts to cool, then remove the bolt protectors. Check bolts for weld spatter and remove if necessary.

Mounting Bolt Installation Test Procedure.

The mounting bolts can be checked for proper alignment by temporarily installing an extensometer and monitoring the electrical output during the tightening stages. The extensometer selected for this test should be the one assigned to the location. Equipment required for the test includes an ohmmeter, a six volt battery and a high impedance DC voltmeter. Note these items are NOT provided as part of the RFS 3 system. (see parts list in chapter 10). Before installing the extensometer, check for the correct terminal resistance with the ohmmeter as follows:-

a) Check resistance between BLACK and GREEN terminals. This should be in accordance with calibration sheet value.
b) Check resistance between RED and WHITE terminals. This should be in accordance with calibration sheet value.
c) Check insulation resistance between any terminal and the extensometer body. This should be not less than 5000 megohms.

NOTE

> **NOTE**
>
> Do not use an instrument that has an excitation voltage greater than 20 volts as damage to the extensometer **may** occur.

If the extensometer is within the limits specified above, test for bolt alignment as follows:-

a) Position the extensometer on the bolts as shown in fig 3-9. the terminal block should be at the top.
b) Connect the six volt battery to the BLACK (-) and GREEN (+) terminals of the extensometer and the voltmeter to the RED (-) and WHITE (+) terminals. Set the voltmeter to cover a signal of 0-1 V DC.
c) Place a 1/2 by 7/8 by 1/32 inch washer and a half inch nyloc nut on each bolt.
d) Tighten each nut alternately with a torque wrench to 800 lb inch in steps of 100 lb inch while monitoring the extensometer output with the voltmeter. The output should not exceed 144 mV (24mV/V with the 6 volt battery) at any time during the tightening process.
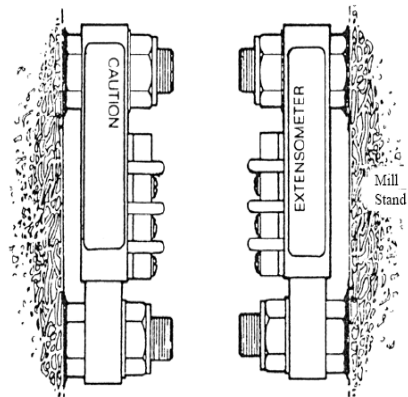
Fig 3.9 Extensometer installed on Mounting Bolts

In the event that the output rises above the 144 mV limit, tightening should be stopped immediately to avoid damaging the extensometer.

When the test is completed, or terminated because of excessive output, remove the battery and voltmeter leads from the extensometer terminals and alternately loosen the nuts. Then remove the extensometer from the bolts and set it aside in a safe place.

If the alignment test was terminated for excessive output, the bolts will have to be removed from the mill post and the installation areas resurfaced to a flat condition in preparation for a new installation. Then the entire bolt installation and test procedure will have to be repeated.

Bolt installation can be considered satisfactory if the extensometer output remains within the 144 mV (24mV/V) limit during tightening.

ENCLOSURE INSTALLATION

The following instructions are for permanently attaching the protective enclosure over the extensometer. The mounting bolts for the extensometer, which should have already been welded in place on the mill post are used to locate and hold the enclosure for welding.

ENCLOSURE INSTALLATION EQUIPMENT

In addition to welding equipment and ½ inch and ¾ inch socket spanners, the following equipment and materials are required for enclosure installation. Note that items a, b,and c are included in BLH Installation kit P/N 429662. Items d and e are also available but are not supplied as part of the system and have to be ordered separately.

a. Enclosure Welding Device P/N 428792.

b. Two 1/2-13 Hex Nuts, P/N 123250.

c. Two Bolt protectors, P/N 429661.

d. Two 14 oz cartridges of protective grease (PQC-40AA-1), P/N 145480.

e. One 10 cc tube LOCTITE 290 Weld Seal, P/N 144512.
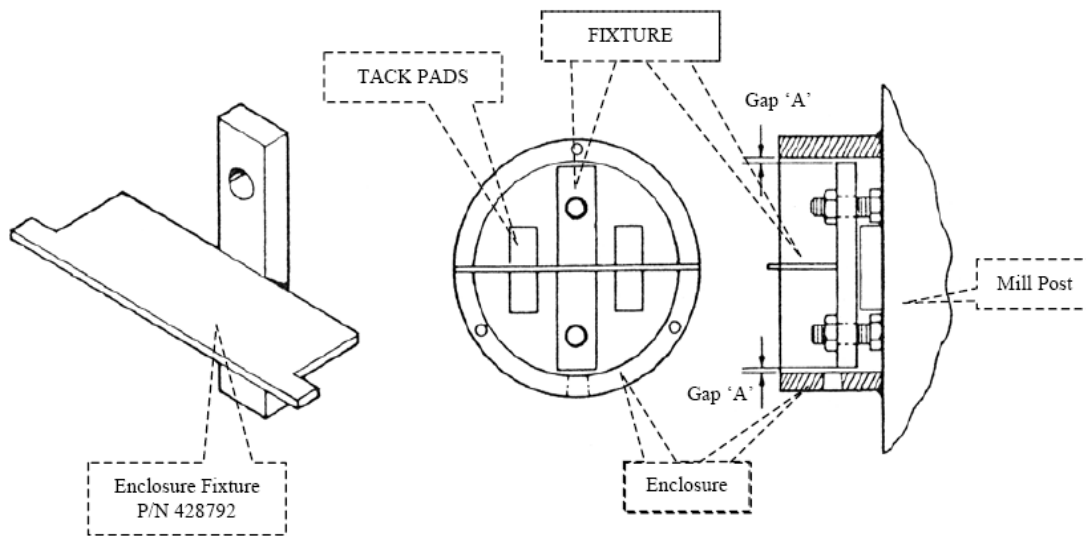
Fig 3.10 Enclosure with Installation Fixture

Install the extensometer enclosure as follows:-

a) Remove the cover, gasket and foam insert from the enclosure assembly. Refer to fig. 3-1.
b) Insert the welding fixture into the enclosure as shown in fig. 3-10. Orientate as indicated.
c) Place the enclosure fixture on the extensometer bolts previously welded to the mill posts. The holes in the fixture fit over the bolts. Use the 1/2-13 nuts to hold the enclosure/fixture in place.

d) Rotate the enclosure to locate the conduit hole. It is important that the conduit hole is located at the bottom to prevent contaminants from collecting in the housing. Check that gaps 'A' shown in fig. 3-10, are at least 1/16 inch (1.5 mm), then tighten the two hex nuts lightly to hold the assembly in place.

e) Tack weld enclosure to mill post in several places.

f) Loosen and remove nuts from the extensometer bolts and then remove the fixture.

g) Weld a fillet completely around the outside of the enclosure to ensure a liquid tight seal. Avoid weld spatter on the cover edge of the enclosure. Remove any spatter that may have occurred.

h) It may be necessary to weld around the inside of the enclosure to produce a satisfactory liquid tight-seal. If so, use bolt protectors to prevent weld spatter on the threads of the mounting bolts.

i) After the enclosure has cooled, paint the weld around the outside of the enclosure with the LOCTITE 290.

j) Attach conduit and feed cable into enclosure.

Extensometer Mounting.

Complete the installation by mounting the extensometer, wiring the unit, checking the electrical connections, insulating and covering as follows:-

a) Check the mounting bolts for weld spatter. Remove as necessary.

b) Apply a half inch (12 mm) layer of protective grease (P/N 145480) to the area between the bolts on the mill post.

c) Position the extensometer on the bolts as shown in fig. 3-9. The terminal block should be on the top.

d) Connect the six volt battery to the BLACK (-) and GREEN (+) terminals of the extensometer and the voltmeter to the RED (-) and WHITE (+) terminals. Set the voltmeter to cover a signal of 0-1 V DC.

e) Place a 1/2 by 7/8 by 1/32 inch washer and a half inch nyloc nut on each bolt.

f) Tighten each nut alternately with a torque wrench to 800 lb inch in steps of 100 lb inch while monitoring the extensometer output with the

Fig 3.11 Cutaway View of Completed Assembly

voltmeter. The output should not exceed 144 mV at any time during the tightening process. Remove the battery and voltmeter leads from the extensometer when the tightening is complete.

g) Check resistance between BLACK and GREEN terminals. This should be in accordance with the calibration sheet value.

h) Check resistance between RED and WHITE terminals. This should be in accordance with the calibration sheet value.

i) Check insulation resistance between any terminal and the extensometer body. This should be not less than 5000 megohms.

j) Connect the cables from the instrumentation to the extensometer colour for colour i.e. RED to RED, WHITE to WHITE etc. Observe caution label instructions. If the standard colour code cable is not used take great care that the correct connections are made otherwise irreparable damage could be done to the extensometer and the instrumentation

k) Fill cavity at bottom of insulation insert with the protective grease P/N 145480.

l) Install insulation insert over extensometer. Wiring should be routed to avoid the insert, and if necessary, the insulation can be cut to clear the conduit fitting and cable.

m) Place gasket and cover on the enclosure and align the holes.

n) Install the six cap head screws and tighten sufficiently to seal the enclosure without over compressing the gasket.
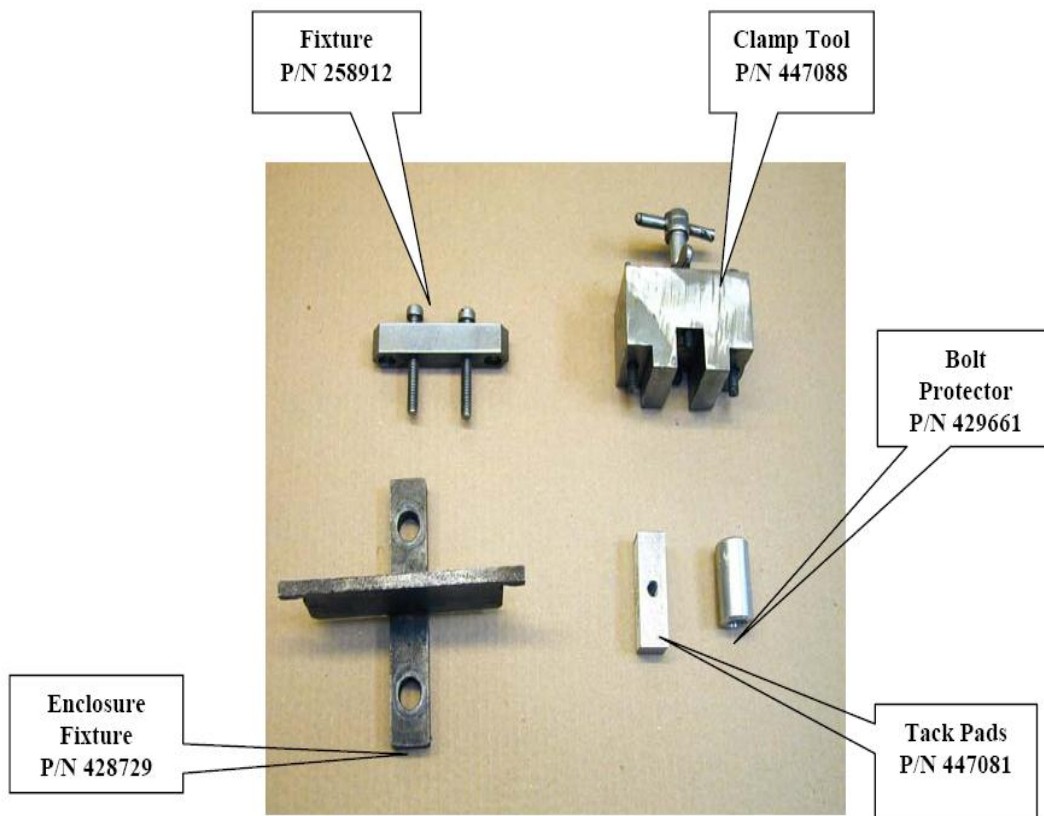
4 INSTRUMENT CALIBRATION

PREPARING THE RFS 4 SYSTEM PRIOR TO INSTALLATION

These consist of calculating the extensometer signal output level at full-scale roll force. These values and the values of the Zero Track, Metal In Mill and overload Levels can then be entered into the G4 unit.
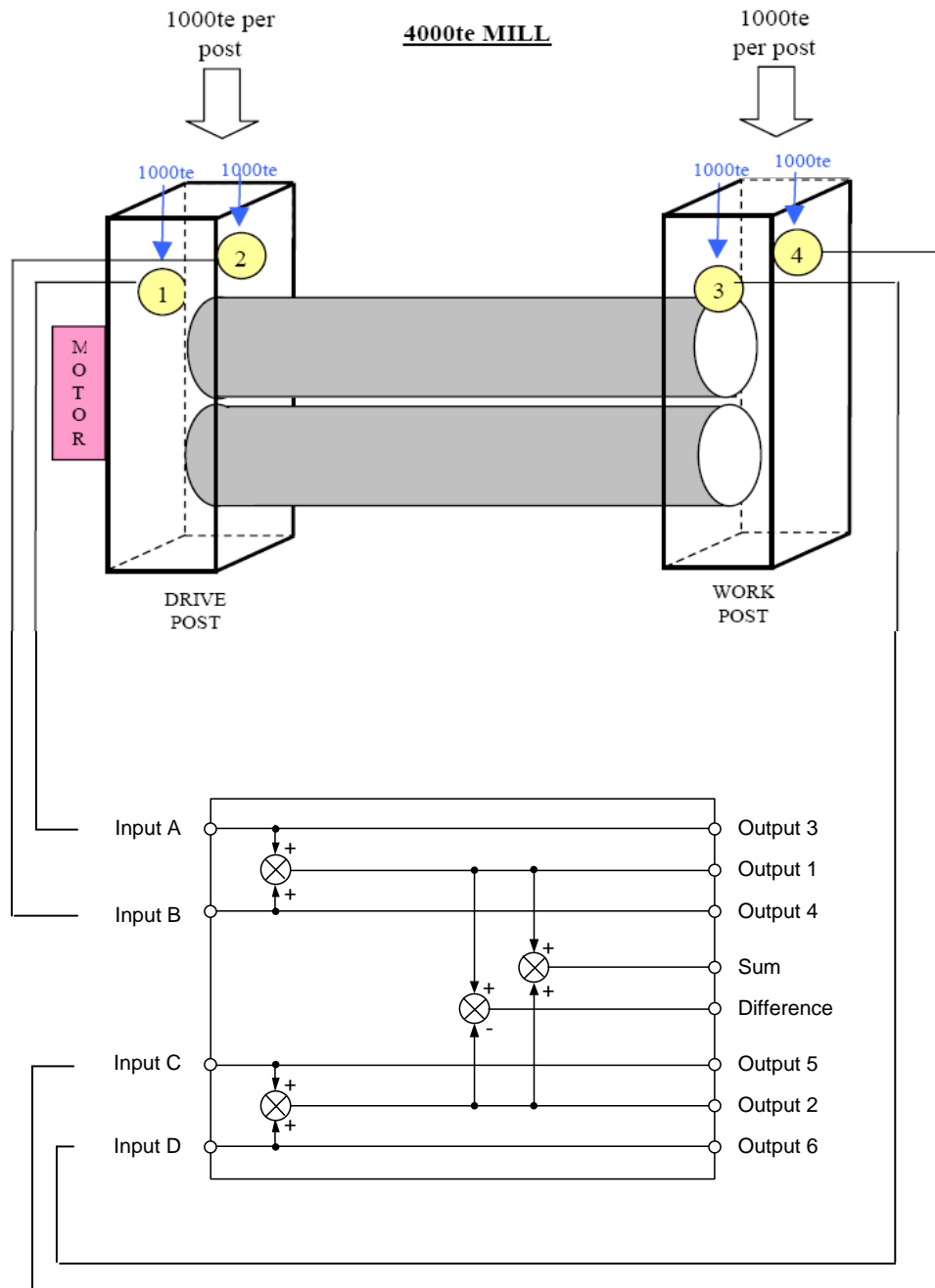
EXTENSOMETER OUTPUT CALCULATION

The extensometers supplied with the system are factory calibrated for a sensitivity of 4 mV/V/1000 psi (4 mV output per volt of excitation/per 1000 psi of stress in posts) To determine the signal output of the extensometers at full scale roll force calculate the full scale stress at the cross section of the mill post where the extensometers are installed, divide by 1000 and then multiply by 4mV. For example, the full scale stress on one post of a 4000 te mill at a point where the post measures 711 mm x 864 mm (28 x 34 inches) is:-

$$\frac{4000 \times 2204.6}{4 \times 28 \times 34} = 2315.8 \text{ psi} \text{ (stress per post)}$$

Therefore, full scale output of each extensometer equals:-

$$\frac{2315.8 \times 4 \text{ mV/V}}{1000} = 9.26 \text{ mV/V}$$

Number of posts
Metric range of mill in te
Metric/imperial conversion tonne to lbs
Size of mill(inches)

The above procedure assumes each post is of the same area a[...] extensometers are installed. If not the calculation must be modified accordingly. **When the calculation is complete record the result for use in the next procedure.**

Chapter 10 includes a template sheet for calculating the calibration parameters.

G4 ANALOG OUTPUT SETTING

If the G4 system is equipped with an AOUT4 module (four analog outputs) the analog outputs should be configured in the set-up as follows.

- AOUT4 Source – Drive force measurement
- AOUT3 Source – Work force measurement
- AOUT2 Source – Sum force measurement (Drive + Work forces)
- AOUT1 Source – Difference force measurement (Work – Drive forces)

The output full scale value should be set accordingly.

Note that the SUM output should be set to twice the load value of each side as it is summing together the 2 sides of the mill.

i.e. –

   If the load on each post of the mill is 1000 te then:

- The full scale value of the analog output 2 should be programmed to 4000te.
- All the other analog outputs full scale values should be programmed as 2000te.

OFF-LINE TESTING OF THE SYSTEM (DRY RUN)

This section describes how to test the electronic rack of the system before connecting it to the extensometers and to the mill control system. It is intended to verify that the rack internal wiring, G4 setup files, and analog outputs definitions are according to the site desired configuration.

The description will follow the **standard configuration** definitions. If the wiring and setup for the specific site are different the user should make the relevant changes in the process as required.

If an analog module (AOUT4) is **not** present in the system (values are communicated via communication ports), ignore the DVM readings in the tests below.

Record all measurements and setting in the checklist shown in appendix 1.

Required test equipment:

- 4 x Calibrator model BLH 625 (or similar).
- 4 x dgital volt meters (DVMs)

Test procedure:

1. Connect the Calibrators to the rack extensometers inputs according to their wiring definitions. Note the polarity of the signals. See appendix 2, showing the wiring for the standard configuration.
2. Connect the DVMs to the analog outputs of the rack. Note the polarity of the signals.
3. Check that the G4 set-up parameters are setup according to the required configuration for the site. The setup file for the standard configuration is defined in Chapter 8. If the unit is not setup correctly, download the configuration file using the 'Restore backup' functionality in the 'Maintenance' menu, or set them up manually (see chapter 7 in **G4 Multi Channel Force Instrument Technical Manual PM/DT/HE** (600896)).
4. Make sure that the G4 is in normal operation mode.
5. Set the Drive calibrators to intermediate output level within the range expected in the mill, and the WORK calibrators to zero level.
6. Check the following in the G4 'Diagnostics' menu under 'Functions Blocks':
- Input A shows the Drive A calibrator mV/V level.
- Input B shows the Drive B calibrator mV/V level.
- Input C shows 0 mV/V readings
- Input D shows 0 mV/V readings
- The DVM connected to the Drive Analog Output shows the equivalent voltage reading to the calibrator mV/V input.
- The DVM connected to the Work Anlaog Output of the rack shows the zero voltage level.
- The DVM connected to the SUM Analog output shows the equivalent voltage reading to the Drive calibrator mV/V input.
- The DVM connected to the DIFF Analog output shows the NEGATIVE equivalent voltage reading to the Drive calibrator mV/V input.
7. Set the DRIVE calibrators to zero and set the WORK calibrators to output level within the range expected in the mill.
8. Check the following outputs:
- Input A shows the 0mV/V.
- Input B shows the 0mV/V.
- Input C shows the Work A calibrator mV/V readings.
- Input D shows the Work B calibrator mV/V readings.
- The DVM connected to the Drive Analog Output of the rack shows the zero level.

- The DVM connected to the Work Anlaog Output of the rack shows the equivalent voltage reading to the Work calibrator mV/V input.
- The DVM connected to the SUM Analog output shows the equivalent voltage reading to the Work calibrator mV/V input.
- The DVM connected to the DIFF Analog output shows the POSITIVE equivalent voltage reading to the WORK calibrator mV/V input.

9. Set the Drive calibrators to about half the value of the WORK calibrators level.
10. Check the following outputs:
- Input A shows the level in mV/V equivalent to the Drive A calibrator level.
- Input B shows the level in mV/V equivalent to the Drive B calibrator level.
- Input C shows the Work A calibrator mV/V readings.
- Input D shows the Work B calibrator mV/V readings.
- The DVM connected to the Drive Analog Output of the rack shows voltage reading equivalent to the Drive calibrator level.
- The DVM connected to the Work Anlaog Output of the rack shows the equivalent voltage reading to the Work calibrator mV/V input.
- The DVM connected to the SUM Analog output shows the equivalent voltage reading to the sum of the Drive and Work calibrators mV/V input.
- The DVM connected to the DIFF Analog output shows the POSITIVE equivalent voltage reading to the difference between WORK and Drive calibrator mV/V input (Work – Drive).

11. Disconnect the calibrators and DVMs from the rack.

INITIAL CONNECTION OF G4

The wiring between the extensometers and the junction box and the junction box to the RFS 4 enclosure should be checked against the specific site wiring diagram. Typical connections are shown in standard drawings (see Appendix 3 – 6).

CALIBRATING THE RFS 4 SYSTEM

1. Once the wiring has been checked, the RFS 4 may be connected to the power supply

2. If wiring is faulty, then the instrument will indicate 'ERROR 11, 13' or similar.

3. Each channel will display an arbitrary value. Until calibration has been done, this value is irrelevant and may be ignored. Enter the 'Diagnostics' menu for this function block by pressing the 'INFO' key and then walk through the menus 'Maintenance/Diagnostics/Function/Blocks'. Here the raw values of the outputs from the extensometers is displayed which should be max 10 mV/V. If this shows a greater value, then return to chapter 3 and check the extensometer installation.

4. Calibrate the system using the 'Table calibration' type (see also Technical Manual for G4 Multi Channel Force Instrument chapter 5 'Calibration', (600896)). The values that should be used (same for all inputs) are as calculated before (Extensometer Output Calculation, p.18). Using the previous example, the values are as follows:

	Value Cal.	Transducer Signal
Point 1	0.0	0.0
Point 2	1000	9.26

5. Set the zero value by entering the parameter 'Set Zero'

SETTING THE "OVERLOAD" AND "METAL IN MILL" LEVELS

Any of the 32 level functions can be used for supervising levels in the mill.

The METAL IN MILL level number is defined in the calibration menu for the function block. As default the parameter 'Metal in mill Level no.' is set to '1', meaning that Level Function 1 (In menu [Parameter Set-up/Level Supervision/Level 1/] parameters should be set as desired. As default the 'Source' parameter is set to 'Sum' meaning that the supervision is made on the sum value. The 'Level 1' value is set in the menu [Main menu/Levels].

One or more overload levels are then set using 'Level 2' to 'Level 32' functions.

ZERO TRACK FUNCTION

In the RFS 4 system the METAL IN MILL and ZERO TRACK LEVEL are separate values; each should be chosen for their own criteria.

The ZERO TRACK function enables any long-term drift in the zero reading to be removed. After every pre-set time period the system records the present reading and averages it, along with the previous 10 reading, to offset the zero.

Set-up parameters in the calibration menu for the function block can determine the ZT Level, time period and filter length. Each input operates independently, although if the SUM is greater than the METAL IN THE MILL level then, irrespective of whether the individual input reading is above or below the ZT level, ZERO TRACKING will not occur.

Every weight update (e.g. 20 ms at 50 Hz Update Rate) the counter (ZT FILTER COUNT) is decremented and when it reaches zero the new force value is stored in the filter array. An average value is derived from the previous readings (determined by FILTER SIZE setting) and subtracted from the new force value. So any step increase in the input signal will take:

{20 X FILTER COUNT X FILTER SIZE} (in ms) before the reading stabilises.

Example

Update rate = 50Hz

FILTER Count = 10
Filter Size = 10

100 ms

STEP INPUT

New value added to filter array and new ZT offset calculated... repeated every 200 ms

DISPLAYED VALUE WITH ZT ON
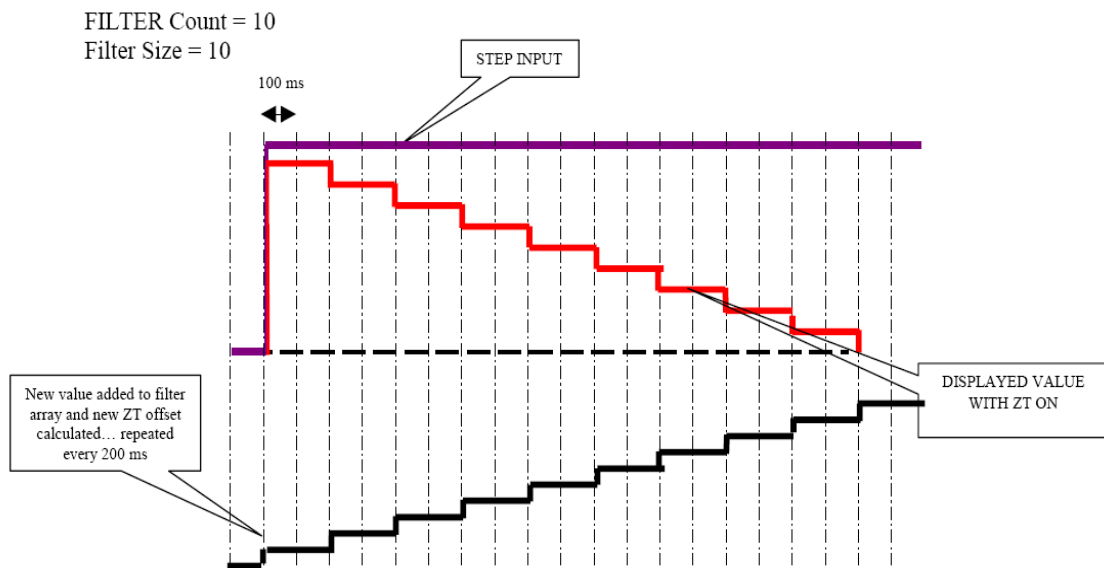
SETTING THE ZERO TRACK LEVEL AND FILTER COUNT

In the calibration menu for the function block, there are 4 parameters defining how the zero track function will work.

Update Rate

Range: See 'Technical manual'	Standard parameter defining the update rate of the force value. In this program also defining the time between the update of the zero track filter. E.g. if the update rate is set to 50 Hz, the time between update of the zero track filter will be 20 ms.

Zero Track Level

Range: -999999 999999 <0>	This parameter is common for all extensometers (inputs), and is a level compared with each input and disconnecting the zero track function if the actual value is above set level.

ZT Filter Size

Range: 1-10 <10>	This parameter defines the size of the zero track filter, that is how many values (elements) should be included in the filter array.

ZT Filter Count

Range: 0-100 <10>	This parameter defines, when zero track function is active, how often a value should be entered into the zero track filter array (

5 COMMUNICATION

Communication with the mill control is done as fully described in the Technical Manual for **G4 Multi Channel Force Instrument** chapter 7 'Communication' (600896) with the following additions:

Command register

One new command (for each function block) has been added to the command register (42000 or 46000) in the RFS4 software version:

Cmd	Action activated in instrument	Description
X1	Turn on/off zero track filter	*Used to turn on or off the zero track function for function block X* *Example: command 11 turns on zero track function for function block 1*

Function Block X: Status

Status for a Function Block.

Bits set to 1 in this register have the following meaning:

One bit is added in the RFS4 software version for indicating the zero track filter on or off

Bit no	Function	Comment
0	Input A faulty	There is an error on Input A. See 'Block X: Error code'.
1	Input B faulty	There is an error on Input B. See 'Block X: Error code'.
2	Input C faulty	There is an error on Input C. See 'Block X: Error code'.
3	Input D faulty	There is an error on Input D. See 'Block X: Error code'.
4		
5		
6		
7	Zero Track On	Indicating that zero track function is on
8		
I		
13		
14		
15		

6 TESTING OPERATION AS A MONITOR SYSTEM

This section is describing the testing of the system AFTER connecting the extensometers to the rack and proper setup of the G4 parameters according to the system required configuration. The description below is assuming the **standard configuration of the system.** If the site configuration is different changes should be made accordingly.

If an analog module (AOUT4) is **not** present in the system (values are communicated via communication ports), ignore the DVM readings in the tests below.

Required test equipment:

- 4 x Digital volt meters (DVM)

Test Procedure:

1. **Make sure that the analog outputs of the rack are DISCONNCTED from the mill's control system**.
2. Connect the DVMs to the analog outputs.
3. Remove any load from the mill (set it at its normal zero level).
4. Check that the system is showing:
   - All Inputs A,B,C,D show 0 for No Load in the Mill.
   - All DVMs connected to the analog outputs shows the current or voltage level equivalent to zero load (4mA or 0 vdc).
5. Apply an intermediate load to the mill. Check the outputs from the system as follows:
   - The Drive side Input (A+B) are showing the same readings as applicable to the drive side force.
   - The Work side Input (C+D) are showing the same readings as applicable to the work side force.
   - The Drive analog output DVM shows voltage reading equivalent to the Drive load applied.
   - The Work output DVM shows voltage reading equivalent to the Work load applied.
   - The Sum output DVM shows voltage reading equivalent to the sum of the work and drive loads.
   - The Diff output DVM shows voltage reading equivalent to the (Work – Drive) loads applied.
   - The filedbus data output shows the equivalent readings as described above in numeric format.
6. Record all your readings in the checklist in appendix 4
7. Disconnect the DVMs from the rack.

⚠️	**After setting and testing the system calibration, readings and verification that all analog outputs are corresponding correctly to the input signals, the analog outputs may be connected to the mill control system.**

7 SET-UP LIST (standard configuration)

Below follows an example of the complete set-up list for the RFS4 G4 System.

The blue (striped) parameters are normally not used and can be left with the default setting.

Name	Value
Language	English
InstrumentName	
Startmode	Auto
DisplayMode	1 FB
ViewPanDispContrast	5
DateFormat	YYYY-MM-DD
ZeroKey	On
OperatorLock	Off
OperatorCode	1937
SetupLock	Off
SetupCode	1937
TimeFormat	24 h
FieldbusType	Profibus
Slot1ModuleType	HSWF2
Slot2ModuleType	HSWF2
Slot3ModuleType	AOUT4
Slot4ModuleType	No module
Slot5ModuleType	No module
Slot6ModuleType	No module
FuncBlock1Type	4 Channel
FuncBlock1InpA	Slot 1, Ch 1
FuncBlock1InpB	Slot 1, Ch 2
FuncBlock1InpC	Slot 2, Ch 1
FuncBlock1InpD	Slot 2, Ch 2
FuncBlock2Type	Not In Use
FuncBlock2InpA	Not In Use
FuncBlock2InpB	Not In Use
FuncBlock2InpC	Not In Use
FuncBlock2InpD	Not In Use
FuncBlock3Type	Not In Use
FuncBlock3InpA	Not In Use
FuncBlock3InpB	Not In Use
FuncBlock3InpC	Not In Use
FuncBlock3InpD	Not In Use
FuncBlock4Type	Not In Use
FuncBlock4InpA	Not In Use
FuncBlock4InpB	Not In Use
FuncBlock4InpC	Not In Use
FuncBlock4InpD	Not In Use
FuncBlock5Type	Not In Use
FuncBlock5InpA	Not In Use
FuncBlock5InpB	Not In Use
FuncBlock5InpC	Not In Use
FuncBlock5InpD	Not In Use
FuncBlock6Type	Not In Use
FuncBlock6InpA	Not In Use
FuncBlock6InpB	Not In Use
FuncBlock6InpC	Not In Use
FuncBlock6InpD	Not In Use
FuncBlock7Type	Not In Use

Name	Value
FuncBlock7InpA	Not In Use
FuncBlock7InpB	Not In Use
FuncBlock7InpC	Not In Use
FuncBlock7InpD	Not In Use
FuncBlock8Type	Not In Use
FuncBlock8InpA	Not In Use
FuncBlock8InpB	Not In Use
FuncBlock8InpC	Not In Use
FuncBlock8InpD	Not In Use
1:FuncBlockName	
1:SumGraphMax	4000
1:DiffGraphMax	2000
1:TensionMode	Off
1:MeasUnit	t
1:Resolution	1
1:WebTensionUnit	N/m
1:WebTensionRes	1
1:WebTensionFactor	1
1:HSWF_UpdateRate	50 Hz
1:WFIN_UpdateRate	300 Hz
1:MIMLevelNo	1
1:ZTLevel	20
1:ZTSize	10
1:ZTCount	50
1:CalibType	Table
1:AValueCalP1	0
1:ATransdSignP1	0.00000
1:AValueCalP2	1000
1:ATransdSignP2	9.26
1:ASetZero	0
1:AZeroOffset	0
1:BValueCalP1	0
1:BTransdSignP1	0.00000
1:BValueCalP2	1000
1:BTransdSignP2	9.26
1:BSetZero	0
1:BZeroOffset	0
1:CValueCalP1	0
1:CTransdSignP1	0.00000
1:CValueCalP2	1000
1:CTransdSignP2	9.26
1:CSetZero	0
1:CZeroOffset	0
1:DValueCalP1	0
1:DTransdSignP1	0.00000
1:DValueCalP2	1000
1:DTransdSignP2	9.26
1:DSetZero	0
1:DZeroOffset	0
2:FuncBlockName	
2:SumGraphMax	1000

2:DiffGraphMax	100		3:ZTSize	10
2:TensionMode	Off		3:ZTCount	20
2:MeasUnit	N		3:CalibType	Table
2:Resolution	1		3:AValueCalP1	0
2:WebTensionUnit	N/m		3:ATransdSignP1	0.000
2:WebTensionRes	1		3:AValueCalP2	1000
2:WebTensionFactor	1		3:ATransdSignP2	2.00000
2:HSWF_UpdateRate	800 Hz		3:ASetZero	0
2:WFIN_UpdateRate	300 Hz		3:AZeroOffset	0
2:MIMLevelNo	1		3:BValueCalP1	0
2:ZTLevel	0		3:BTransdSignP1	0.000
2:ZTSize	10		3:BValueCalP2	1000
2:ZTCount	20		3:BTransdSignP2	2.00000
2:CalibType	Table		3:BSetZero	0
2:AValueCalP1	0		3:BZeroOffset	0
2:ATransdSignP1	0.000		3:CValueCalP1	0
2:AValueCalP2	1000		3:CTransdSignP1	0.000
2:ATransdSignP2	2.00000		3:CValueCalP2	1000
2:ASetZero	0		3:CTransdSignP2	2.00000
2:AZeroOffset	0		3:CSetZero	0
2:BValueCalP1	0		3:CZeroOffset	0
2:BTransdSignP1	0.000		3:DValueCalP1	0
2:BValueCalP2	1000		3:DTransdSignP1	0.000
2:BTransdSignP2	2.00000		3:DValueCalP2	1000
2:BSetZero	0		3:DTransdSignP2	2.00000
2:BZeroOffset	0		3:DSetZero	0
2:CValueCalP1	0		3:DZeroOffset	0
2:CTransdSignP1	0.000		4:FuncBlockName	
2:CValueCalP2	1000		4:SumGraphMax	1000
2:CTransdSignP2	2.00000		4:DiffGraphMax	100
2:CSetZero	0		4:TensionMode	Off
2:CZeroOffset	0		4:MeasUnit	N
2:DValueCalP1	0		4:Resolution	1
2:DTransdSignP1	0.000		4:WebTensionUnit	N/m
2:DValueCalP2	1000		4:WebTensionRes	1
2:DTransdSignP2	2.00000		4:WebTensionFactor	1
2:DSetZero	0		4:HSWF_UpdateRate	800 Hz
2:DZeroOffset	0		4:WFIN_UpdateRate	300 Hz
3:FuncBlockName			4:MIMLevelNo	1
3:SumGraphMax	1000		4:ZTLevel	0
3:DiffGraphMax	100		4:ZTSize	10
3:TensionMode	Off		4:ZTCount	20
3:MeasUnit	N		4:CalibType	Table
3:Resolution	1		4:AValueCalP1	0
3:WebTensionUnit	N/m		4:ATransdSignP1	0.000
3:WebTensionRes	1		4:AValueCalP2	1000
3:WebTensionFactor	1		4:ATransdSignP2	2.00000
3:HSWF_UpdateRate	800 Hz		4:ASetZero	0
3:WFIN_UpdateRate	300 Hz		4:AZeroOffset	0
3:MIMLevelNo	1		4:BValueCalP1	0
3:ZTLevel	0		4:BTransdSignP1	0.000

4:BValueCalP2	1000		5:DTransdSignP1	0.000
4:BTransdSignP2	2.00000		5:DValueCalP2	1000
4:BSetZero	0		5:DTransdSignP2	2.00000
4:BZeroOffset	0		5:DSetZero	0
4:CValueCalP1	0		5:DZeroOffset	0
4:CTransdSignP1	0.000		6:FuncBlockName	
4:CValueCalP2	1000		6:SumGraphMax	1000
4:CTransdSignP2	2.00000		6:DiffGraphMax	100
4:CSetZero	0		6:TensionMode	Off
4:CZeroOffset	0		6:MeasUnit	N
4:DValueCalP1	0		6:Resolution	1
4:DTransdSignP1	0.000		6:WebTensionUnit	N/m
4:DValueCalP2	1000		6:WebTensionRes	1
4:DTransdSignP2	2.00000		6:WebTensionFactor	1
4:DSetZero	0		6:HSWF_UpdateRate	800 Hz
4:DZeroOffset	0		6:WFIN_UpdateRate	300 Hz
5:FuncBlockName			6:MIMLevelNo	1
5:SumGraphMax	1000		6:ZTLevel	0
5:DiffGraphMax	100		6:ZTSize	10
5:TensionMode	Off		6:ZTCount	20
5:MeasUnit	N		6:CalibType	Table
5:Resolution	1		6:AValueCalP1	0
5:WebTensionUnit	N/m		6:ATransdSignP1	0.000
5:WebTensionRes	1		6:AValueCalP2	1000
5:WebTensionFactor	1		6:ATransdSignP2	2.00000
5:HSWF_UpdateRate	800 Hz		6:ASetZero	0
5:WFIN_UpdateRate	300 Hz		6:AZeroOffset	0
5:MIMLevelNo	1		6:BValueCalP1	0
5:ZTLevel	0		6:BTransdSignP1	0.000
5:ZTSize	10		6:BValueCalP2	1000
5:ZTCount	20		6:BTransdSignP2	2.00000
5:CalibType	Table		6:BSetZero	0
5:AValueCalP1	0		6:BZeroOffset	0
5:ATransdSignP1	0.000		6:CValueCalP1	0
5:AValueCalP2	1000		6:CTransdSignP1	0.000
5:ATransdSignP2	2.00000		6:CValueCalP2	1000
5:ASetZero	0		6:CTransdSignP2	2.00000
5:AZeroOffset	0		6:CSetZero	0
5:BValueCalP1	0		6:CZeroOffset	0
5:BTransdSignP1	0.000		6:DValueCalP1	0
5:BValueCalP2	1000		6:DTransdSignP1	0.000
5:BTransdSignP2	2.00000		6:DValueCalP2	1000
5:BSetZero	0		6:DTransdSignP2	2.00000
5:BZeroOffset	0		6:DSetZero	0
5:CValueCalP1	0		6:DZeroOffset	0
5:CTransdSignP1	0.000		7:FuncBlockName	
5:CValueCalP2	1000		7:SumGraphMax	1000
5:CTransdSignP2	2.00000		7:DiffGraphMax	100
5:CSetZero	0		7:TensionMode	Off
5:CZeroOffset	0		7:MeasUnit	N
5:DValueCalP1	0		7:Resolution	1

7:WebTensionUnit	N/m		8:ATransdSignP1	0.000
7:WebTensionRes	1		8:AValueCalP2	1000
7:WebTensionFactor	1		8:ATransdSignP2	2.00000
7:HSWF_UpdateRate	800 Hz		8:ASetZero	0
7:WFIN_UpdateRate	300 Hz		8:AZeroOffset	0
7:MIMLevelNo	1		8:BValueCalP1	0
7:ZTLevel	0		8:BTransdSignP1	0.000
7:ZTSize	10		8:BValueCalP2	1000
7:ZTCount	20		8:BTransdSignP2	2.00000
7:CalibType	Table		8:BSetZero	0
7:AValueCalP1	0		8:BZeroOffset	0
7:ATransdSignP1	0.000		8:CValueCalP1	0
7:AValueCalP2	1000		8:CTransdSignP1	0.000
7:ATransdSignP2	2.00000		8:CValueCalP2	1000
7:ASetZero	0		8:CTransdSignP2	2.00000
7:AZeroOffset	0		8:CSetZero	0
7:BValueCalP1	0		8:CZeroOffset	0
7:BTransdSignP1	0.000		8:DValueCalP1	0
7:BValueCalP2	1000		8:DTransdSignP1	0.000
7:BTransdSignP2	2.00000		8:DValueCalP2	1000
7:BSetZero	0		8:DTransdSignP2	2.00000
7:BZeroOffset	0		8:DSetZero	0
7:CValueCalP1	0		8:DZeroOffset	0
7:CTransdSignP1	0.000		ModbusAddress	1
7:CValueCalP2	1000		COM1Mode	Modbus Slave
7:CTransdSignP2	2.00000		COM1Baudrate	19200
7:CSetZero	0		COM1DataFormat	8-none-1
7:CZeroOffset	0		COM1MinReplyTime	0
7:DValueCalP1	0		COM1FloatFormat	Modicon Float
7:DTransdSignP1	0.000		COM2Mode	Not In Use
7:DValueCalP2	1000		COM2Baudrate	9600
7:DTransdSignP2	2.00000		COM2DataFormat	8-none-1
7:DSetZero	0		COM2MinReplyTime	0
7:DZeroOffset	0		COM2FloatFormat	Modicon Float
8:FuncBlockName			ModbusTCPSlave	Off
8:SumGraphMax	1000		FloatFormat	Modicon Float
8:DiffGraphMax	100		ProfibusAddress	126
8:TensionMode	Off		DeviceNetAddress	63
8:MeasUnit	N		CANopenAddress	127
8:Resolution	1		DeviceNetBaudrate	Auto
8:WebTensionUnit	N/m		CANopenBaudrate	Auto
8:WebTensionRes	1		NoOfDataBlocks	0
8:WebTensionFactor	1		DataBlock1Type	Not In Use
8:HSWF_UpdateRate	800 Hz		DataBlock1Format	Floating Point
8:WFIN_UpdateRate	300 Hz		DataBlock1FBNo	1
8:MIMLevelNo	1		DataBlock2Type	Not In Use
8:ZTLevel	0		DataBlock2Format	Floating Point
8:ZTSize	10		DataBlock2FBNo	1
8:ZTCount	20		DataBlock3Type	Not In Use
8:CalibType	Table		DataBlock3Format	Floating Point
8:AValueCalP1	0		DataBlock3FBNo	1

DataBlock4Type	Not In Use		Level4Output	Active Above
DataBlock4Format	Floating Point		Level4Hysteres	2
DataBlock4FBNo	1		Level4UpDelay	0
DataBlock5Type	Not In Use		Level4DownDelay	0
DataBlock5Format	Floating Point		Level5Source	Not In Use
DataBlock5FBNo	1		Level5Mode	Normal
DataBlock6Type	Not In Use		Level5FuncBlock	1
DataBlock6Format	Floating Point		Level5Output	Active Above
DataBlock6FBNo	1		Level5Hysteres	2
DataBlock7Type	Not In Use		Level5UpDelay	0
DataBlock7Format	Floating Point		Level5DownDelay	0
DataBlock7FBNo	1		Level6Source	Not In Use
DataBlock8Type	Not In Use		Level6Mode	Normal
DataBlock8Format	Floating Point		Leve6FuncBlock	1
DataBlock8FBNo	1		Level6Output	Active Above
DataBlock9Type	Not In Use		Level6Hysteres	2
DataBlock9Format	Floating Point		Level6UpDelay	0
DataBlock9FBNo	1		Level6DownDelay	0
DataBlock10Type	Not In Use		Level7Source	Not In Use
DataBlock10Format	Floating Point		Level7Mode	Normal
DataBlock10FBNo	1		Level7FuncBlock	1
DataBlock11Type	Not In Use		Level7Output	Active Above
DataBlock11Format	Floating Point		Level7Hysteres	2
DataBlock11FBNo	1		Level7UpDelay	0
DataBlock12Type	Not In Use		Level7DownDelay	0
DataBlock12Format	Floating Point		Level8Source	Not In Use
DataBlock12FBNo	1		Level8Mode	Normal
Level1Source	Sum		Level8FuncBlock	1
Level1Mode	Normal		Level8Output	Active Above
Level1FuncBlock	1		Level8Hysteres	2
Level1Output	Active Above		Level8UpDelay	0
Level1Hysteres	2		Level8DownDelay	0
Level1UpDelay	0		Level9Source	Not In Use
Level1DownDelay	0		Level9Mode	Normal
Level2Source	Sum		Level9FuncBlock	1
Level2Mode	Normal		Level9Output	Active Above
Level2FuncBlock	1		Level9Hysteres	2
Level2Output	Active Above		Level9UpDelay	0
Level2Hysteres	2		Level9DownDelay	0
Level2UpDelay	0		Level10Source	Not In Use
Level2DownDelay	0		Level10Mode	Normal
Level3Source	Not In Use		Level10FuncBlock	1
Level3Mode	Normal		Level10Output	Active Above
Level3FuncBlock	1		Level10Hysteres	2
Level3Output	Active Above		Level10UpDelay	0
Level3Hysteres	2		Level10DownDelay	0
Level3UpDelay	0		Level11Source	Not In Use
Level3DownDelay	0		Level11Mode	Normal
Level4Source	Not In Use		Level11FuncBlock	1
Level4Mode	Normal		Level11Output	Active Above
Level4FuncBlock	1		Level11Hysteres	2

Level11UpDelay	0		Level19Source	Not In Use
Level11DownDelay	0		Level19Mode	Normal
Level12Source	Not In Use		Level19FuncBlock	1
Level12Mode	Normal		Level19Output	Active Above
Level12FuncBlock	1		Level19Hysteres	2
Level12Output	Active Above		Level19UpDelay	0
Level12Hysteres	2		Level19DownDelay	0
Level12UpDelay	0		Level20Source	Not In Use
Level12DownDelay	0		Level20Mode	Normal
Level13Source	Not In Use		Level20FuncBlock	1
Level13Mode	Normal		Level20Output	Active Above
Level13FuncBlock	1		Level20Hysteres	2
Level13Output	Active Above		Level20UpDelay	0
Level13Hysteres	2		Level20DownDelay	0
Level13UpDelay	0		Level21Source	Not In Use
Level13DownDelay	0		Level21Mode	Normal
Level14Source	Not In Use		Level21FuncBlock	1
Level14Mode	Normal		Level21Output	Active Above
Level14FuncBlock	1		Level21Hysteres	2
Level14Output	Active Above		Level21UpDelay	0
Level14Hysteres	2		Level21DownDelay	0
Level14UpDelay	0		Level22Source	Not In Use
Level14DownDelay	0		Level22Mode	Normal
Level15Source	Not In Use		Level22FuncBlock	1
Level15Mode	Normal		Level22Output	Active Above
Level15FuncBlock	1		Level22Hysteres	2
Level15Output	Active Above		Level22UpDelay	0
Level15Hysteres	2		Level22DownDelay	0
Level15UpDelay	0		Level23Source	Not In Use
Level15DownDelay	0		Level23Mode	Normal
Level16Source	Not In Use		Leve23FuncBlock	1
Level16Mode	Normal		Level23Output	Active Above
Level16FuncBlock	1		Level23Hysteres	2
Level16Output	Active Above		Level23UpDelay	0
Level16Hysteres	2		Level23DownDelay	0
Level16UpDelay	0		Level24Source	Not In Use
Level16DownDelay	0		Level24Mode	Normal
Level17Source	Not In Use		Level24FuncBlock	1
Level17Mode	Normal		Level24Output	Active Above
Level17FuncBlock	1		Level24Hysteres	2
Level17Output	Active Above		Level24UpDelay	0
Level17Hysteres	2		Level24DownDelay	0
Level17UpDelay	0		Level25Source	Not In Use
Level17DownDelay	0		Level25Mode	Normal
Level18Source	Not In Use		Level25FuncBlock	1
Level18Mode	Normal		Level25Output	Active Above
Level18FuncBlock	1		Level25Hysteres	2
Level18Output	Active Above		Level25UpDelay	0
Level18Hysteres	2		Level25DownDelay	0
Level18UpDelay	0		Level26Source	Not In Use
Level18DownDelay	0		Level26Mode	Normal

Level26FuncBlock	1		Input13Use	Not In Use
Level26Output	Active Above		Input13FuncBlock	1
Level26Hysteres	2		Input14Use	Not In Use
Level26UpDelay	0		Input14FuncBlock	1
Level26DownDelay	0		Input15Use	Not In Use
Level27Source	Not In Use		Input15FuncBlock	1
Level27Mode	Normal		Input16Use	Not In Use
Level27FuncBlock	1		Input16FuncBlock	1
Level27Output	Active Above		Input17Use	Not In Use
Level27Hysteres	2		Input17FuncBlock	1
Level27UpDelay	0		Input18Use	Not In Use
Level27DownDelay	0		Input18FuncBlock	1
Level28Source	Not In Use		Input21Use	Not In Use
Level28Mode	Normal		Input21FuncBlock	1
Level28FuncBlock	1		Input22Use	Not In Use
Level28Output	Active Above		Input22FuncBlock	1
Level28Hysteres	2		Input23Use	Not In Use
Level28UpDelay	0		Input23FuncBlock	1
Level28DownDelay	0		Input24Use	Not In Use
Level29Source	Not In Use		Input24FuncBlock	1
Level29Mode	Normal		Input25Use	Not In Use
Level29FuncBlock	1		Input25FuncBlock	1
Level29Output	Active Above		Input26Use	Not In Use
Level29Hysteres	2		Input26FuncBlock	1
Level29UpDelay	0		Input27Use	Not In Use
Level29DownDelay	0		Input27FuncBlock	1
Level30Source	Not In Use		Input28Use	Not In Use
Level30Mode	Normal		Input28FuncBlock	1
Level30FuncBlock	1		Input31Use	Not In Use
Level30Output	Active Above		Input31FuncBlock	1
Level30Hysteres	2		Input32Use	Not In Use
Level30UpDelay	0		Input32FuncBlock	1
Level30DownDelay	0		Input33Use	Not In Use
Level31Source	Not In Use		Input33FuncBlock	1
Level31Mode	Normal		Input34Use	Not In Use
Level31FuncBlock	1		Input34FuncBlock	1
Level31Output	Active Above		Input35Use	Not In Use
Level31Hysteres	2		Input35FuncBlock	1
Level31UpDelay	0		Input36Use	Not In Use
Level31DownDelay	0		Input36FuncBlock	1
Level32Source	Not In Use		Input37Use	Not In Use
Level32Mode	Normal		Input37FuncBlock	1
Level32FuncBlock	1		Input38Use	Not In Use
Level32Output	Active Above		Input38FuncBlock	1
Leve3l2Hysteres	2		Input41Use	Not In Use
Level32UpDelay	0		Input41FuncBlock	1
Level32DownDelay	0		Input42Use	Not In Use
Input11Use	Not In Use		Input42FuncBlock	1
Input11FuncBlock	1		Input43Use	Not In Use
Input12Use	Not In Use		Input43FuncBlock	1
Input12FuncBlock	1		Input44Use	Not In Use

Input44FuncBlock	1
Input45Use	Not In Use
Input45FuncBlock	1
Input46Use	Not In Use
Input46FuncBlock	1
Input47Use	Not In Use
Input47FuncBlock	1
Input48Use	Not In Use
Input48FuncBlock	1
Input51Use	Not In Use
Input51FuncBlock	1
Input52Use	Not In Use
Input52FuncBlock	1
Input53Use	Not In Use
Input53FuncBlock	1
Input54Use	Not In Use
Input54FuncBlock	1
Input55Use	Not In Use
Input55FuncBlock	1
Input56Use	Not In Use
Input56FuncBlock	1
Input57Use	Not In Use
Input57FuncBlock	1
Input58Use	Not In Use
Input58FuncBlock	1
Input61Use	Not In Use
Input61FuncBlock	1
Input62Use	Not In Use
Input62FuncBlock	1
Input63Use	Not In Use
Input63FuncBlock	1
Input64Use	Not In Use
Input64FuncBlock	1
Input65Use	Not In Use
Input65FuncBlock	1
Input66Use	Not In Use
Input66FuncBlock	1
Input67Use	Not In Use
Input67FuncBlock	1
Input68Use	Not In Use
Input68FuncBlock	1
Output11Source	Level
Output11Level	1
Output12Source	Level
Output12Level	2
Output13Source	Not In Use
Output13Level	1
Output14Source	Not In Use
Output14Level	1
Output15Source	Not In Use
Output15Level	1

Output16Source	Not In Use
Output16Level	1
Output17Source	Not In Use
Output17Level	1
Output18Source	Not In Use
Output18Level	1
Output21Source	In Process
Output21Level	1
Output22Source	Not In Use
Output22Level	1
Output23Source	Not In Use
Output23Level	1
Output24Source	Not In Use
Output23Level	1
Output25Source	Not In Use
Output25Level	1
Output26Source	Not In Use
Output26Level	1
Output27Source	Not In Use
Output27Level	1
Output28Source	Not In Use
Output28Level	1
Output31Source	Not In Use
Output31Level	1
Output32Source	Not In Use
Output32Level	1
Output33Source	Not In Use
Output33Level	1
Output34Source	Not In Use
Output34Level	1
Output35Source	Not In Use
Output35Level	1
Output36Source	Not In Use
Output36Level	1
Output37Source	Not In Use
Output37Level	1
Output38Source	Not In Use
Output38Level	1
Output41Source	Not In Use
Output41Level	1
Output42Source	Not In Use
Output42Level	1
Output43Source	Not In Use
Output43Level	1
Output44Source	Not In Use
Output44Level	1
Output45Source	Not In Use
Output45Level	1
Output46Source	Not In Use
Output46Level	1
Output47Source	Not In Use

Output47Level	1		AOUT3Source	Output 1
Output48Source	Not In Use		AOUT3FuncBlock	1
Output48Level	1		AOUT3OutpType	0-10 V
Output51Source	Not In Use		AOUT3RangeLow	0
Output51Level	1		AOUT3RangeHigh	2000
Output52Source	Not In Use		AOUT3Bandwidth	100 Hz
Output52Level	1		AOUT3LowAdj	0
Output53Source	Not In Use		AOUT3HighAdj	0
Output53Level	1		AOUT4Source	Output 2
Output54Source	Not In Use		AOUT4FuncBlock	1
Output54Level	1		AOUT4OutpType	0-10 V
Output55Source	Not In Use		AOUT4RangeLow	0
Output55Level	1		AOUT4RangeHigh	2000
Output56Source	Not In Use		AOUT4Bandwidth	100 Hz
Output56Level	1		AOUT4LowAdj	0
Output57Source	Not In Use		AOUT4HighAdj	0
Output57Level	1		DispNoOfBatch	On
Output58Source	Not In Use			
Output58Level	1			
Output61Source	Not In Use			
Output61Level	1			
Output62Source	Not In Use			
Output62Level	1			
Output63Source	Not In Use			
Output63Level	1			
Output64Source	Not In Use			
Output64Level	1			
Output65Source	Not In Use			
Output65Level	1			
Output66Source	Not In Use			
Output66Level	1			
Output67Source	Not In Use			
Output67Level	1			
Output68Source	Not In Use			
Output68Level	1			
AOUT1Source	Difference			
AOUT1FuncBlock	1			
AOUT1OutpType	+/-10 V			
AOUT1RangeLow	0			
AOUT1RangeHigh	2000			
AOUT1Bandwidth	100 Hz			
AOUT1LowAdj	0			
AOUT1HighAdj	0			
AOUT2Source	Sum			
AOUT2FuncBlock	1			
AOUT2OutpType	0-10 V			
AOUT2RangeLow	0			
AOUT2RangeHigh	4000			
AOUT2Bandwidth	100 Hz			
AOUT2LowAdj	0			
AOUT2HighAdj	0			

8 GLOSSARY OF TERMS

TERM	EXPLANATION
ANALOGUE	Engineering unit expressed as voltage or current
DIFFERENCE	WORK - DRIVE
DRIFT	Change in signal around zero due to temperature and noise
DRIVE	Side of roll mill housing, the MOTOR (drive)
EXTENSOMETER	*Semi-Conductor measuring device giving electrical signal equivalent to the force between to bolts.*
GALVANIC ISOLATED	NO voltage connection between two points
LEVELS	Outputs that are either ON or OFF depending on whether above or below LEVEL VALUE
MILL POSTS	Structures supporting the Mill Rollers and drive
MODBUS	Protocol for serial communication within the AST 3P and to DELTACOM
mV/V	Expression showing the relationship between the output voltage against the input voltage
SUM	DRIVE + WORK
WHEATSTONE BRIDGE	Circuit configuration that gives a large voltage output for minor changes in circuit resistance.
WORK	Side of roll mill housing opposite, the MOTOR (drive)
ZERO OFFSET	Amount the Extensometer bridge is offset from the original zero balance of an un-mounted device
ZERO TRACK	Method the zero the reading to compensate for 'DRIFT'

9 PARTS LIST

PART	DESCRIPTION	QTY
	EXTENSOMETER	
	COVER	2 or 4
	GASKET	2 or 4
	INSULATION	2 or 4
428451	ENCLOSURE	2 or 4
123250	PLAIN HEX NUTS 1/2 – 13	2
	HEX NUT NYLOC 1/2-13	4 or 8
	PLAIN WASHERS 1/2 X 7/8 X 1/32	4 or 8
428838	EXTENSOMETER MOUNTING BOLT	4 or 8
447081	TACK PADS	4 or 8
145480	GREASE (PQC-40AA-1) 14 oz	2
144512	LOCTITE 290 WELD SEAL	2 or 4
429661	BOLT PROTECTORS	
	CABLE GLANDS	2 or 4
	CABLE	A/R
	SPADE CONNECTORS	8 or 16
	BOLT 5/16-18 X 3 inch	2
428792	ENCLOSURE WELDING FIXTURE	1
258912	BOLT WELDING FIXTURE	1
447088	CLAMP TOOL	1
	SPIRIT LEVEL	1
	TORQUE WRENCH (67 ft lb)	1
	3/4 AF SOCKET	1
	EXTENSION DRIVE	1
	6 VOLT BATTERY	1
	MULTIMETER	1
	CRIMP TOOL	1
	CABINET CONTAINING ALL ELECTRONICS	1
	M8 X ?? CABINET MOUNTING BOLTS	
	GLANDS FOR ENCLOSURE	
	6 CORE EXTENSOMETER CABLES	

10 Calculation of calibration parameters of the G4

RFS 4 CALIBRATION CALCULATION

CUSTOMER	Vishay	EUNo.	22528

EXTENSOMETER SENSITIVITY	4 mV/V	per	1000	psi
RANGE of Mill	800 te			
SIZE of Mill Posts	21 in	by	17	in

ENTER VALUES HIGHLIGHTED

STRESS PER POST	1235,07 psi		
Output of Ext for	800 te	4,94028 mV/v	

G4 TABLE SETTING	Value Cal	Transd.sign	
	0,00000	0,00000	⬅ ANSWER
	200	4,94028	

DATE   december 29, 2010

STRESS PER POST = Range of Mill x 2204,6 / (4 x Size of Mill posts)

(2204,6 = Metric/imperial conversion tonne to lbs)

Output of Ext for = Range of Mill

Output mV/V value = STRESS PER POST x 4/1000

Appendix 1

Calibration Mill Specific for Dry Run Check List

Total vertical force LB /(4) * (post cross sectional area) = PSI
PSI * 4 mV/V / 1000 = mV/V

DRIVE		0-10 vdc
WORK		0- 10 vdc
SUM		0-10 vdc
DIFF		+/- 10 vdc

Test Procedure

STEP 5   DRIVE CALIBRATORS set to   mV/V
                    WORK CALIBRATORS set to   mV/V

STEP 6   Calibrator   mV/V   Display   Te   Analog DVM   dcv

Input A	DRIVE A		A:		DRIVE	
Input B	DRIVE B		B:		WORK	
Input C	WORK A		C:		SUM	
Input D	WORK B		D:		DIFF	

STEP 7   DRIVE CALIBRATORS set to   mV/V
                    WORK CALIBRATORS set to   mV/V

STEP 8   Calibrator   mV/V   Display   Te   Analog DVM   dcv

Input A	DRIVE A		A:		DRIVE	
Input B	DRIVE B		B:		WORK	
Input C	WORK A		C:		SUM	
Input D	WORK B		D:		DIFF	

STEP 9   DRIVE CALIBRATORS set to   mV/V
                    WORK CALIBRATORS set to   mV/V

STEP 1   Calibrator   mV/V   Display   Te   Analog DVM   dcv

Input A	DRIVE A		A:		DRIVE	
Input B	DRIVE B		B:		WORK	
Input C	WORK A		C:		SUM	
Input D	WORK B		D:		DIFF	

Calibration Example for Dry Run Check List

4000 Te * 2204.6 / 4 * 28" *34" = 2315.8   PSI
2315.8 * 4 mV/V / 1000 = 9.26   mV/V

DRIVE	0-2000 Te	0-10 vdc
WORK	0-2000 Te	0- 10 vdc
SUM	0-2000 Te	0-10 vdc
DIFF	+/- 2000 Te	+/- 10 vdc

Test Procedure

STEP 5   DRIVE CALIBRATORS set to 4.5 mV/V
                    WORK CALIBRATORS set to 0.0 mV/V

STEP 6   Calibrator   mV/V   Display   Te   Analog DVM   dcv

Input A	DRIVE A	4.5	A:	486.0	DRIVE	4.9
Input B	DRIVE B	4.5	B:	486.0	WORK	0
Input C	WORK A	0	C:	0.0	SUM	2.4
Input D	WORK B	0	D:	0.0	DIFF	-4.9

STEP 7   DRIVE CALIBRATORS set to 0.0 mV/V
                    WORK CALIBRATORS set to 4.5 mV/V

STEP 8   Calibrator   mV/V   Display   Te   Analog DVM   dcv

Input A	DRIVE A	0	A:	0.0	DRIVE	0
Input B	DRIVE B	0	B:	0.0	WORK	4.9
Input C	WORK A	4.5	C:	486.0	SUM	2.4
Input D	WORK B	4.5	D:	486.0	DIFF	4.9

STEP 9   DRIVE CALIBRATORS set to 2.5 mV/V
                    WORK CALIBRATORS set to 4.5 mV/V

STEP 10   Calibrator   mV/V   Display   Te   Analog DVM   dcv

Input A	DRIVE A	2.5	A:	270.0	DRIVE	2.7
Input B	DRIVE B	2.5	B:	270.0	WORK	4.9
Input C	WORK A	4.5	C:	486.0	SUM	3.8
Input D	WORK B	4.5	D:	486.0	DIFF	2.2

Appendix 2

Calibration ACTUAL for Dry Run Check List

Total vertical force LB /(4) * (post cross sectional area) =   PSI
PSI * 4 mV/V / 1000 =   mV/V

DRIVE		0-10 vdc
WORK		0- 10 vdc
SUM		0-10 vdc
DIFF		+/- 10 vdc

Test Procedure

STEP 5   DRIVE OPERATOR FORCE
                   WORK OPERATOR FORCE

STEP 6	Pulpet	Force	Display	Te	Analog DVM	dcv
Input A	DRIVE A		A:		DRIVE	
Input B	DRIVE B		B:		WORK	
Input C	WORK A		C:		SUM	
Input D	WORK B		D:		DIFF	

STEP 7   DRIVE OPERATOR FORCE
                   WORK OPERATOR FORCE

STEP 8	Pulpet	Force	Display	Te	Analog DVM	dcv
Input A	DRIVE A		A:		DRIVE	
Input B	DRIVE B		B:		WORK	
Input C	WORK A		C:		SUM	
Input D	WORK B		D:		DIFF	

STEP 9   DRIVE OPERATOR FORCE
                   WORK OPERATOR FORCE

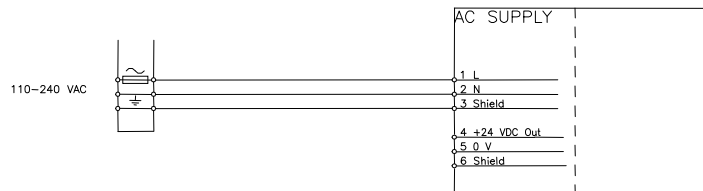| STEP 10	Pulpet	Force	Display	Te	Analog DVM	dcv
Input A	DRIVE A		A:		DRIVE	
Input B	DRIVE B		B:		WORK	
Input C	WORK A		C:		SUM	
Input D	WORK B		D:		DIFF	

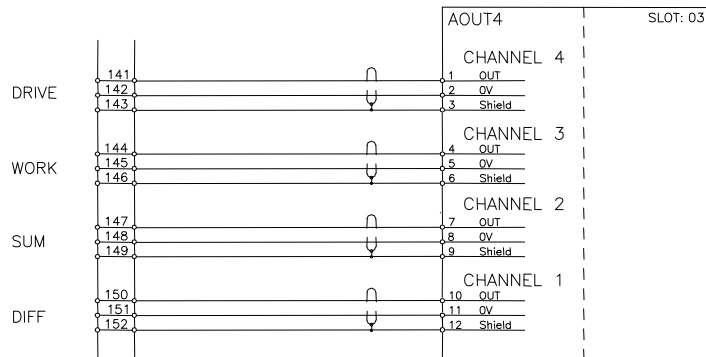## *Appendix 3*

Standard configuration.

Connection of extensometers and digital outputs
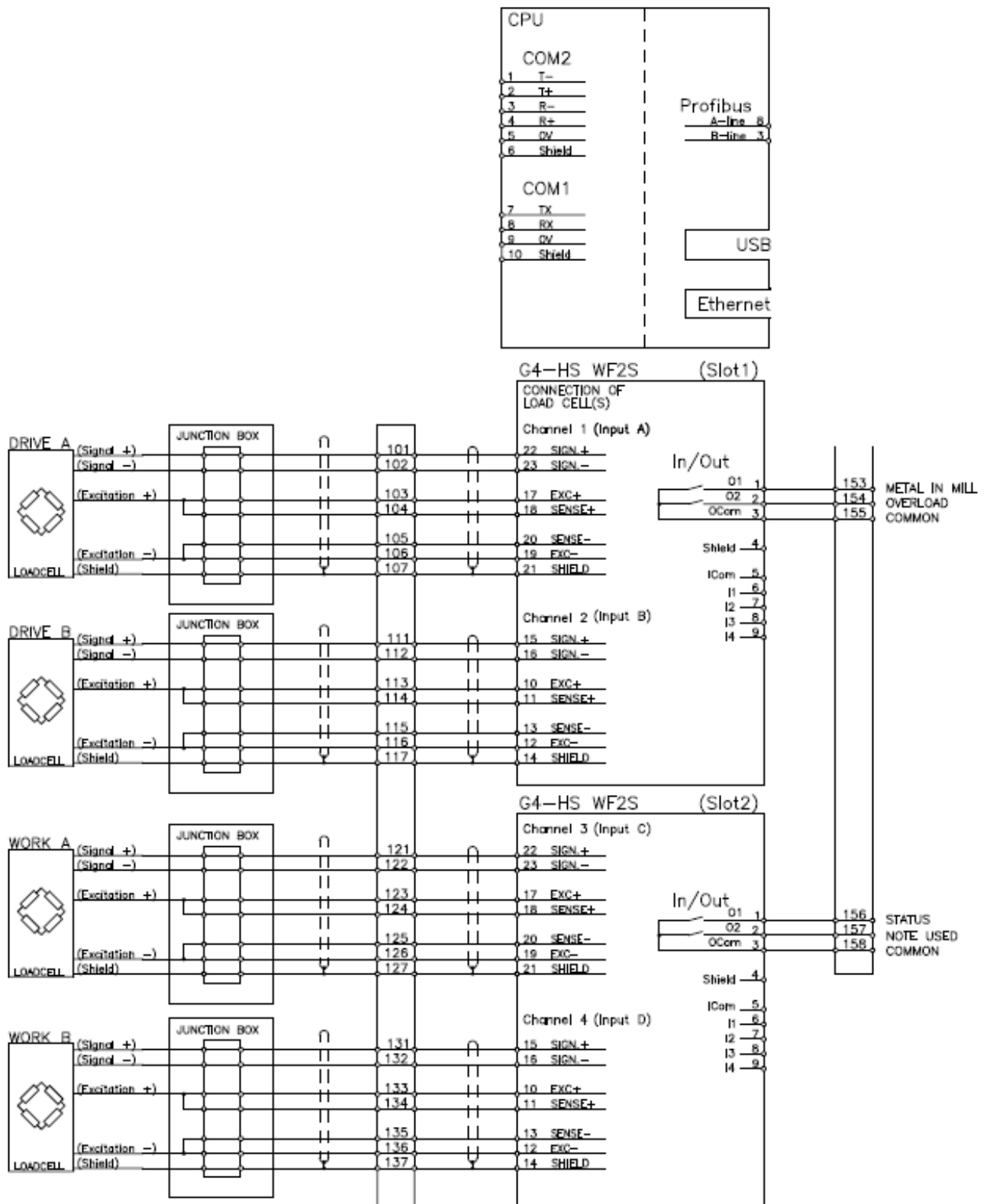
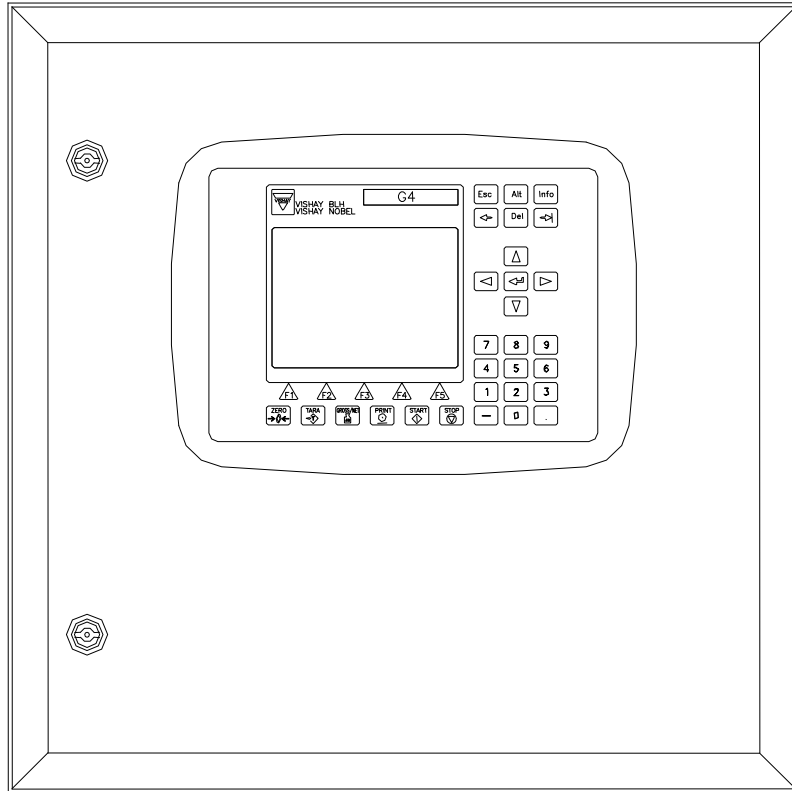## *Appendix 4*

Standard configuration.

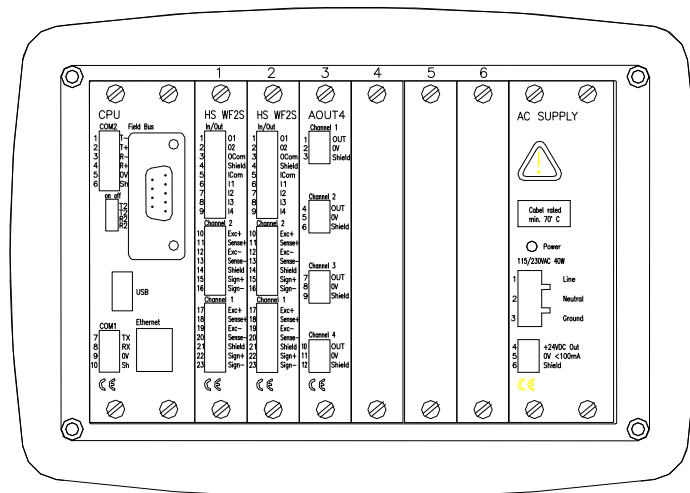Connection of analogue outputs and power supply.

Appendix 5

Standard configuration.

Standard cabinet.
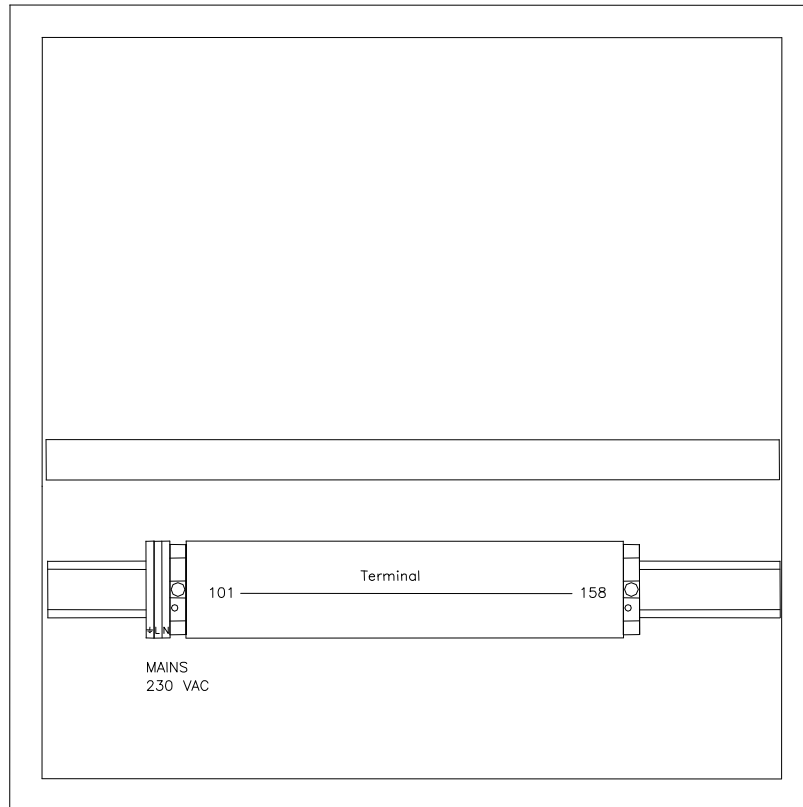

WALL CABINET
WITH GLASED DOOR
DIMENSIONS: 500x500x210

G4 module layout.

Appendix 6

Standard configuration.

Terminal layout in cabinet.

Terminal
101 ———————————————— 158

+LN

MAINS
230 VAC

WALL CABINET
WITH GLASED DOOR
DIMENSIONS: 500x500x210

BLH / Nobel Weighing Systems