MTSWI No.	MTSWI200903	Date -	03/09/2020	Version – 1.2
Task	Test and Calibrate ARI sensors			Timeframe – 2hrs

Materials Required
1. .Site specific hazard ID
2. .MT Training manual
3. .Revise SDS
5. .
6. .
7. .

Equipment and tools
1. .Machine/workbench
2. .Tags
3. .PPE as required
4. .Digital/hand clino
5. .
6. .
7. .

SAFETY MUST BE YOUR FIRST PRIORITY

SAFE WORK INSTRUCTIONS

TEST AND CALIBRATE ARI SENSORS

	Carefully read through relevant machinery information before use		Enclosed steel capped footwear must be worn at all times
	Safety eyewear must be worn at all times		Gloves must be worn if working with high pressure oils, not with rotary equipment
	Hearing protection must be worn		

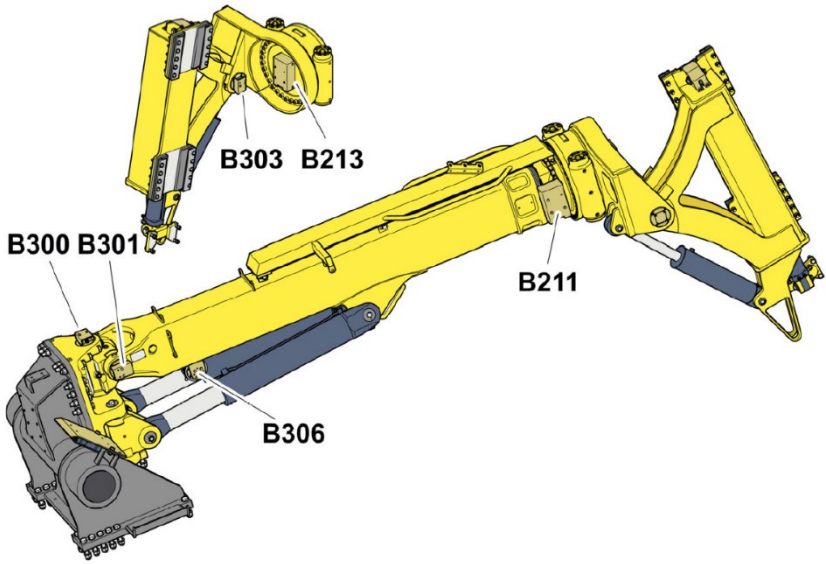
MTSWI No.	MTSWI200903	Date -	03/09/2020	Version - 1.2
Task	Angle Reading Instrument Calibration			

MAINTENANCE TECHNIQUE
UNDERGROUND DRILL RELIABILITY

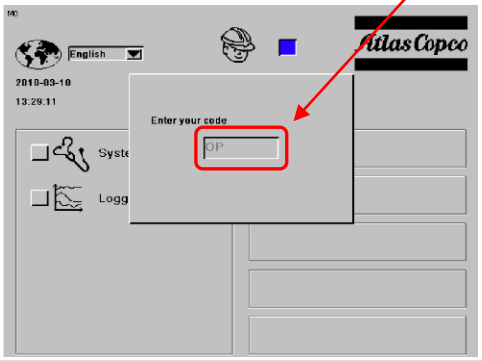
Background - Achieving competent fragmentation in blasting requires production drilling to be completed to as close to the drill plans as possible. The machines angle reading capabilities have been tried and tested as a reliable way of obtaining a correct and accurate means of drilling. As the system relies on readings from the rig level and resolver sensors, these must be in good condition and calibrated accurately to achieve reliable angles.

Note: Whilst calibrating sensors, a previously calibrated sensor must remain in the zero position

Designation	Function
B313	Rig inclination, sideways
B312	Rig inclination, lengthways
B370	Boom Swing
B301	Boom lift, joint angle
B306	Boom extension
B213	Feed Rotation
B303	Feed tilt
B211	Boom lift, angle at front end of boom
B305	Feed Extension



Logging in with USB, use code ↑↓↑↓, without USB ←↓↑→↓←.



MTSWI No.	MTSWI200903	Date -	03/09/2020	Version - 1.2
Task	Test and Calibrate ARI Sensors M/E7C			

MAINTENANCE TECHNIQUE
UNDERGROUND DRILL RELIABILITY

ARI Calibration

Checking the calibration of each individual sensor is critical to the operation of the system, once calibration is complete you must refer to steps 14 through 30.

B313 - Rig Level Sensor (side)

Note – When placing level/manual clino onto equipment you must ensure it is going on a machined surface where possible and that is free from foreign debris or burrs etc. (file off if present).

- **Step 1.** Jack machine up to ¾ of the fully raised position
- **Step 2.** Place level on the boom mantle holder side to side as per fig. 2, level machine using manual clino/level with front jacks.
- **Step 3.** Zero the Rig sidways inclination sensor by pressing the set to zero box as shown in fig. 1.

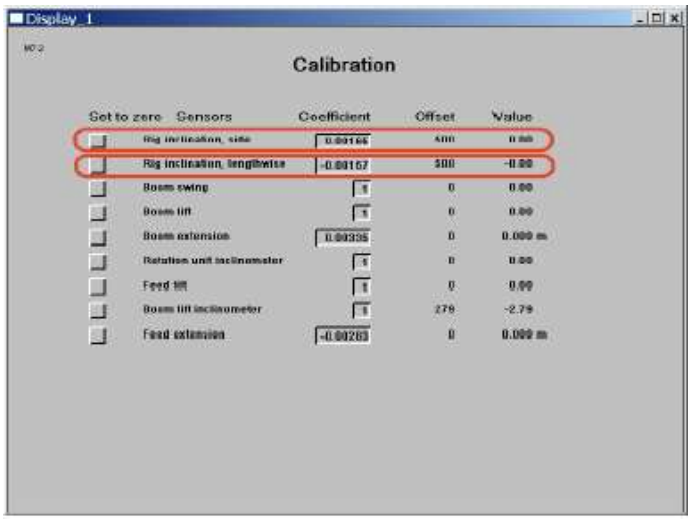


Fig. 1

B312 - Rig Level Sensor (lengthwise).

Note: Ensure when achieving a level length way position ensure that the rig side inclination remains in the zero position this is best acheived if the rig is steered straight.

- **Step 4.** Place level on the boom mantle holder, in a vertical position as per fig. 2 across the top of mounting cap screws, ensuring they are clean, and level machine with front jacks and rear jacks.
- **Step 5.** Zero the Rig inclination sensor by pressing the set to zero box.

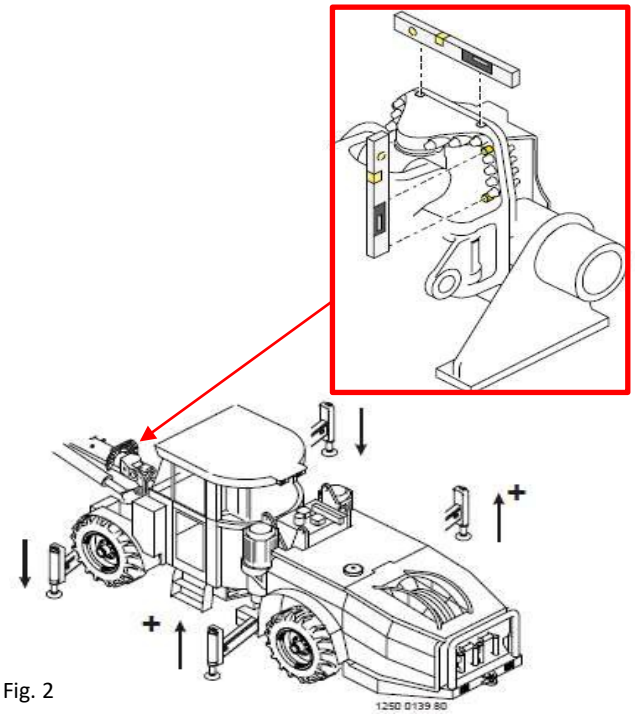


Fig. 2

MTSWI No.	MTSWI200903	Date -	03/09/2020	Version - 1.2
Task	Test and Calibrate ARI sensors			

MAINTENANCE TECHNIQUE
UNDERGROUND DRILL RELIABILITY

B370 – Boom Swing Sensor (Resolver)

Note: Ensure when calibrating ARI sensors that the rig side and length values remains in the zero position.

- **Step 6.** Place the boom straight forward by measuring the boom lift/swing cylinders are at the same length (measure from centre of rod end pin to cylinder barrel) see fig. 1.
- **Step 7.** Zero the Rig resolver sensor by pressing the set to zero box as shown in fig. 2.

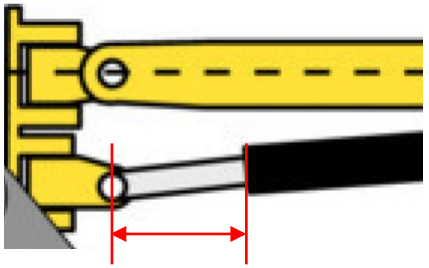


Fig. 1

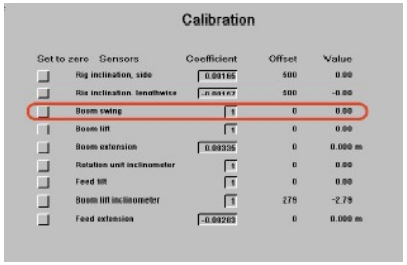


Fig. 2

B301 – Boom Lift Sensor (Inclinometer & Resolver)

Note: Ensure when calibrating ARI sensors that the rig side, length and boom swing and lift values remains in the zero position.

- **Step 8.** With the boom still facing straight forward ensure the zoom tube is fully retracted.
- **Step 9.** Place the level/klino on the rotary actuator as per fig. 3. Zero boom lift resolver first, then zero boom lift inclinometer sensor, by pressing the set to zero box as shown in fig. 4.

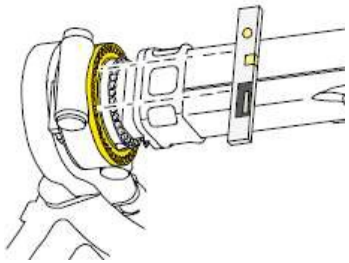


Fig. 3

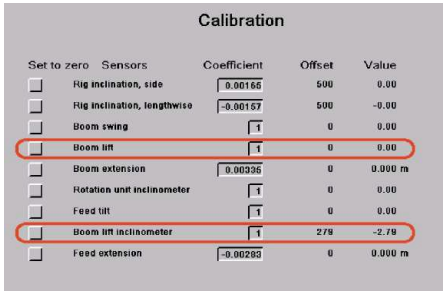


Fig. 4

MTSWI No.	MTSWI200903	Date -	03/09/2020	Version - 1.2
Task	Test and Calibrate ARI sensors			

MAINTENANCE TECHNIQUE
UNDERGROUND DRILL RELIABILITY

B213 – Feed rotation (Inclinometer)

Note: Ensure when calibrating ARI sensors that the rig side, length and boom swing and lift values remains in the zero position.

- **Step 10.** Ensure the boom extension is fully retracted and rotate feeder to the up-hole position.
- **Step 11.** Set the rotation sensor to zero as per fig.2 with a digital/hand clino on the feed slide bar as per fig. 1, with the bit in the up-hole position.

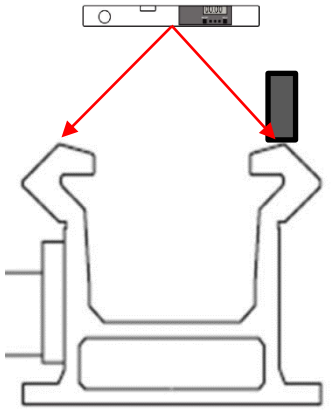


Fig. 1

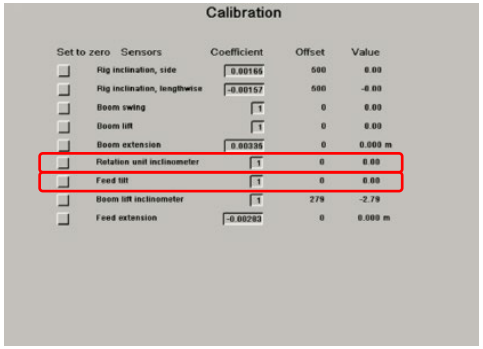


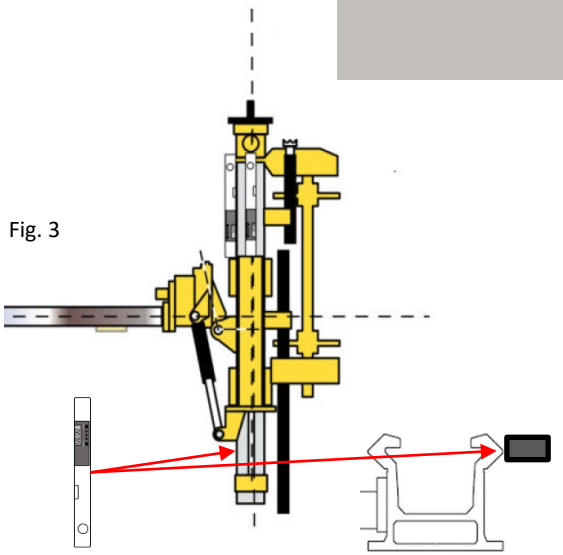
Fig.2

B303 – Feed Tilt (Resolver)

Note: Ensure when calibrating ARI sensors ensure that the rig side and length values remains in the zero position.

- **Step 12.** With the feeder still in the up-hole position, set the feed so that it is perpendicular (right angle) to the boom, measuring with a digital/hand clino on the slide bar of the feed as per fig. 1.
- **Step 13.** Zero the Rig resolver sensor by pressing the set to zero box as shown in fig. 2.

Fig. 3



MTSWI No.	MTSWI200903	Date -	03/09/2020	Version - 1.2
Task	Angle Reading Instrument Calibration			

MAINTENANCE TECHNIQUE
UNDERGROUND DRILL RELIABILITY

Confirming ARI Calibration

B312 - Rig Level Sensor Calibration Confirmation Sideways

Note – *it is critical to confirm the calibration of the rig level sensors, if the coefficient is incorrect the rig will read zero when level, but all other values will be incorrect.*

- **Step 14.** using the same locations as used in step 2, lean the machine over to the right-hand side approx. 2 degrees as per the manual klino/level (see fig. 1) and confirm the value in configuration screen increases. If value decreases or is showing a negative value with the machine leaning to the right, the value will have to be changed to either a + or – coefficent depending on what is already set. i.e. If the coefficient is set as a -0.005 it wil need to be changed to +0.005, as shown in fig. 2.
- **Step 15.** Ensure that the machine angle corresponds in this position, if not adjust the coeffiecent value so that it does. i.e. If and clino reads 2.00 degrees, rig reads 2.50 degrees, adjust rig to match hand clino.
- **Step 16.** Set the machine back to zero (as per the manual klino/level) and zero the sensor again if neccesary.

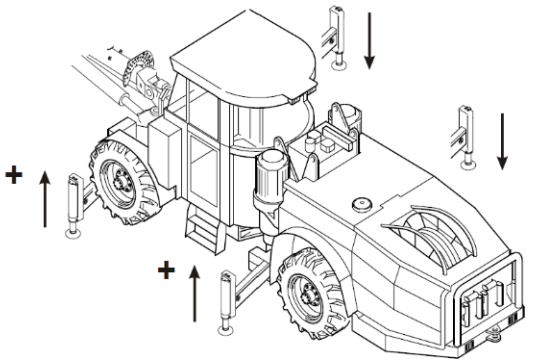


fig. 1

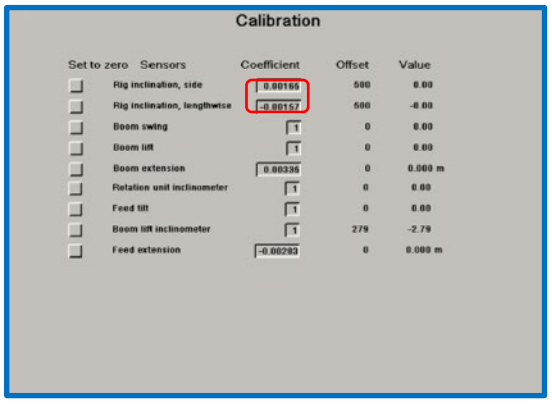


Fig. 2

B313 - Rig Level Sensor Calibration confirmation Lengthwise

Note – *Ensure when achieving a level length way position ensure that the rig side inclination remains in the zero position, this is best acheived if the rig is steered straight.*

- **Step 17.** using the same locations as used in step 2, lean the machine forward approx. 2 degrees as per the manual klino/level (see fig. 3) or as far as possible and confirm the value in configuration screen increases. If value decreases or is showing a negative value with the machine leaning to the forward, the value will have to be changed to either a + or – coefficent depending on what is already set. i.e. If the coefficient is set as a -0.005 it wil need to be changed to +0.005, as shown in fig. 2.
- **Step 18.** Ensure that the machine angle corresponds in this position, if not adjust the coeffiecent value so that it does. i.e. If hand clino reads 2.00 degrees, rig reads 2.50 degrees, adjust rig to match hand clino.
- **Step 19.** Set the machine back to zero (as per the manual klino/level) and zero the sensor again if neccesary

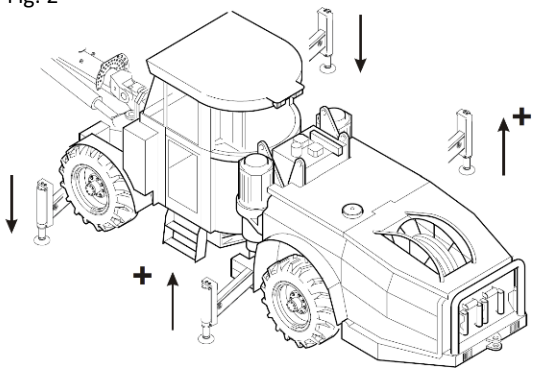


fig. 3

MTSWI No.	MTSWI200903	Date -	03/09/2020	Version - 1.2
Task	Angle Reading Instrument Calibration			

MAINTENANCE TECHNIQUE
UNDERGROUND DRILL RELIABILITY

Confirming ARI Calibration

Setting the Coeffecient of the Sensors – Fig 1

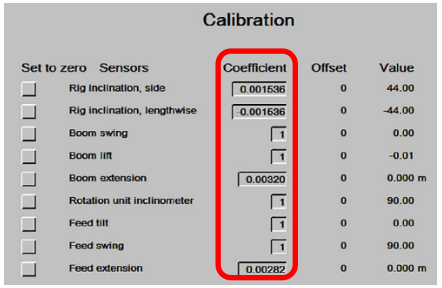


Fig. 1

- **Step 20 - B370 Boom Swing:** Adjust the coefficent (1 or -1) so that the sensor increases in a positive value when the boom swings to the LEFT.

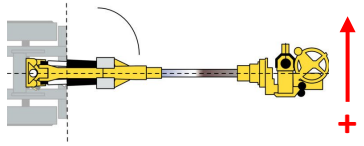


Fig. 2

- **Step 21 - B301 & B211 – Boom Lift Resolver and Inclinometer:** Adjust the coefficent (1 or -1) so that the sensors increases in a positive value when the boom is LOWERED.

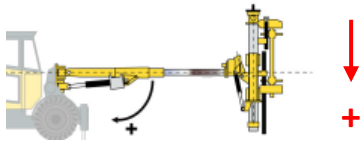


Fig. 3

- **Step 22 - B302 – Feed Rotation Sensor:** Adjust the coefficent (1 or -1) so that the sensor increases in a positive value when rotated in a CLOCKWISE direction (FROM CABIN VIEW).

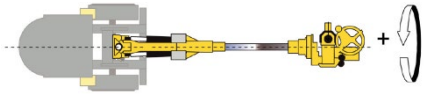


Fig. 4

- **Step 23 - B303 – Feed Tilt Sensor:** Ensure that senor values increase with a positive reading when the feed buffer is moved away from the cabin, if not change coefficent + or -.

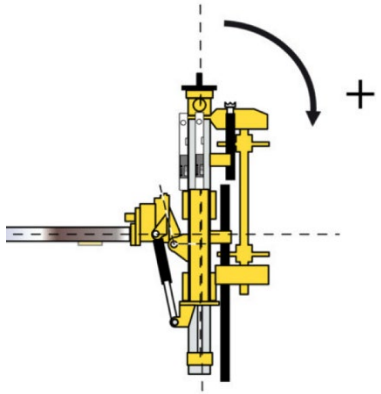


Fig. 5

Note (Quick Test) – Adjust the feed so that it is at 90deg (bit down) on both axis. Open the angle screens and ensure that it reads 90/90.

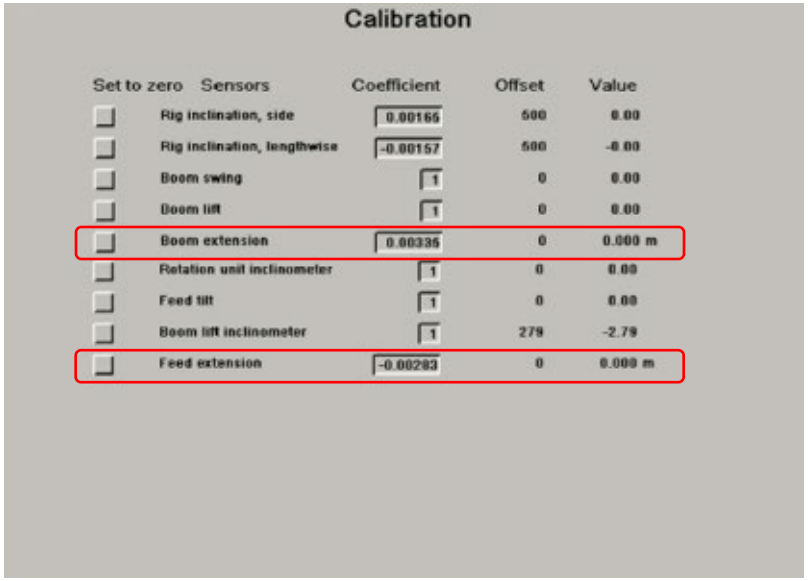
Swing the boom left 1 metre and adjust to 20 deg rotation and 0 degree dump. Place the level/klino on the clip on (ensuring that it is parallel to the machine) to check the accuracy of the rotation and dump. *(Note: There is a tolerance of 1 degree).* Swing the boom to the right and repeat steps.

MAINTENANCE TECHNIQUE
UNDERGROUND DRILL RELIABILITY

The boom and feed extension length sensors can be set in any position, so long as they Are able to be fully extended and retracted.

B306 – Boom Extension (Zoom Tube)

- **Step 24.** Fully retract the boom extension
- **Step 25.** Set the sensor to zero using the 'set to zero' function
- **Step 26.** Fully extend the Boom extension to confirm that a positive value is obtained, if it does not increase with a positive value, change the coefficient (- or +) so that it does.
- **Step 27.** With the boom fully extended the value (length) should be 1.0M for E7C or 1.6M M/E7C, if not, adjust the coefficient until the value shows the correct reading at full extension. This can be checked with a tape measure to ensure accuracy.

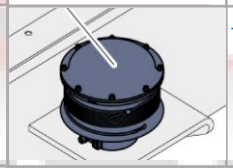
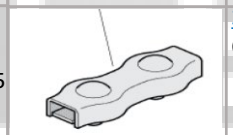
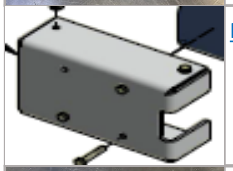
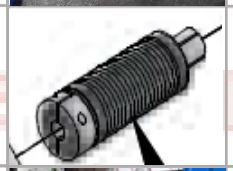


B305 – Feed extension

- **Step 28.** Return the feed extension (rail) to its rearmost position.
- **Step 29.** Set the sensor to zero using the 'set to zero function.
- **Step 30.** Mark the rail with a permanent marker at the forward point of where the slide contacts the rail and extend the feed extension as far forward as it will travel, measure the distance between the mark and the slide where you made the mark and ensure the value corresponds with the measurement.

Please note that if the slides are not adjusted correctly, the rail may bind up, preventing movement and an accurate measurement.

MTSWI No.	MTSWI200903	Date -	03/09/2020	Version – 1.2
Task	S7C Angle Reading Instrument Calibration			Timeframe – 1 hr.

	MT9106 1475 83 – Signal cable. 9M armoured sensor cable, used for B300 & B301.		MT9772 0115 16 – Resolver Seal Kit Prevents resolver failure due to water and contamination ingress.		MT3176 9995 46 – Signal cable 1.5M. Rig level sensor cable.
	9106 1447 65 – Signal cable. 6.1M armoured sensor cable, used for B213 & B303.		MT9106 2192 03 – Resolver sensor.		MT9106 0846 00 – RCS plug repair kit.
	MT9106 1475 63 – Signal cable. 9.3M armoured cable, used for B211.		MT9106 2192 16 – Wire linear sensor.		MT3176 0010 89 – Laser cable 3.5M.
	MT9106 1725 34 – Signal cable. 5M boom & feed extension potentiometer, M23 – M12 used for B305 & B306.		3138 5051 23 – Bulldog grip. OEM supply.		MT3217 9952 12 – Laser.
	MT3128 3077 24 – Resolver cover. RO1 Y13		MT9106 2192 20 – Wire line assy.		MT3217 9952 12M – Laser mount plate.
	MT3128 3228 45 – Inclinometer bracket		MT3128 3059 89 – Bellows coupling.		MT3217 9952 12B – Laser Bracket.
	MT9106 2192 04 – Inclinometer. RO3A6 03		MT3129 1000 20 – Digital protractor.		
	MT9106 2192 03S – Resolver shaft		MT9106 2241 44 – Rig level sensor.		