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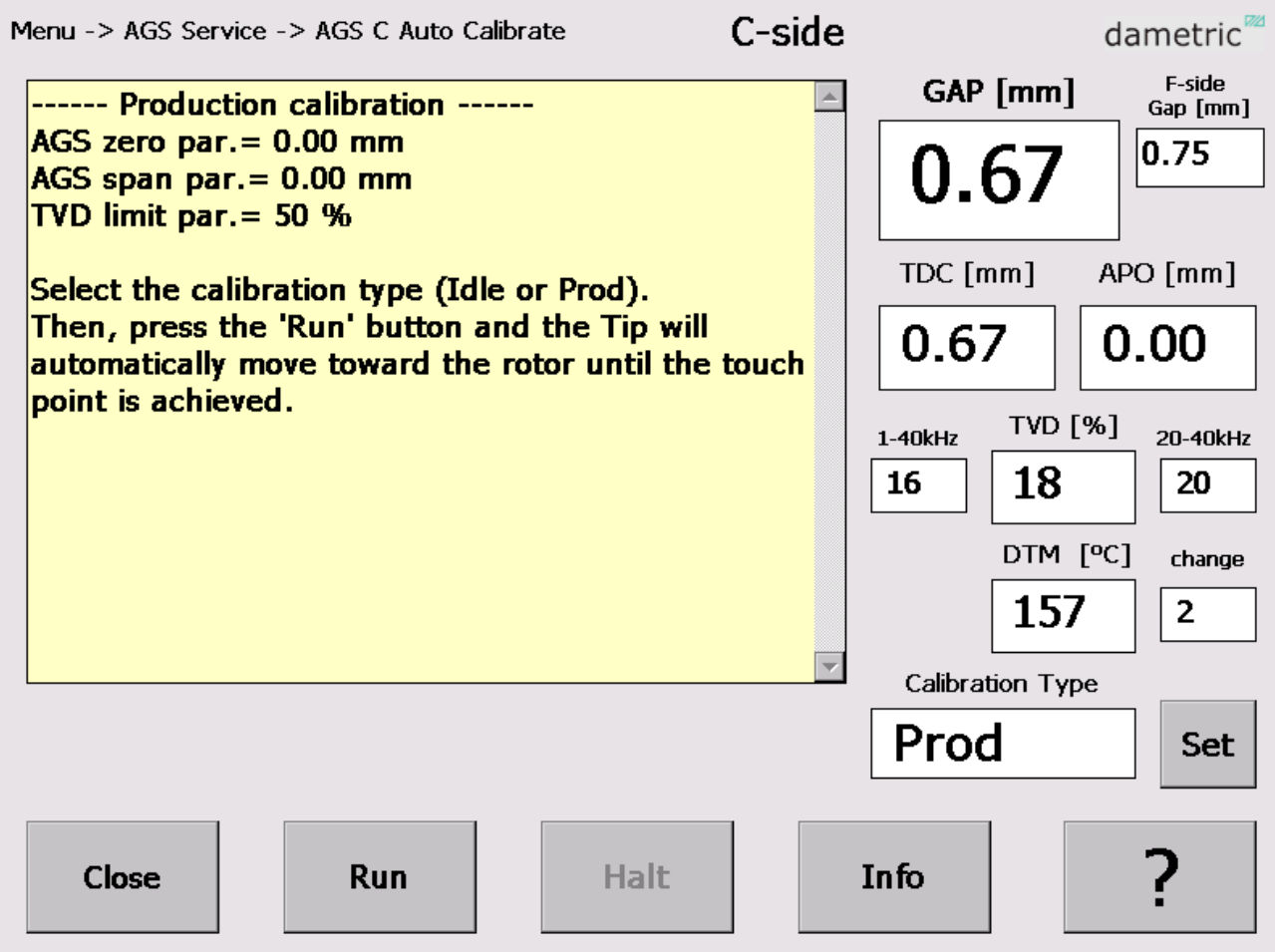
AGS Calibration



GMS CE Panel-PC

Calibration Manual

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1 Overview

This manual describes the process of calibrating the TDC measuring tip in an Adjustable Gap Sensor. The calibration is fully automatic and will gently move the tip toward the rotating rotor until the touch-point is detected. A detected touch-point will stop the movement and save the actual value of the TDC. The tip is then moved backward within some tenths of a second to minimize the time that the tip is touching the rotor. It is moved backward to a span position which normally in 1.0 mm from the touch-point position. The system saves the span value of the TDC and then move the tip to the normal position (aligned with the stator plates) or to a position further out to save the TDC value at the linear check position.
These positions depend of the calibration type, idle or prod (production) and if the sensor is not calibrated in idle mode, an idle calibration must be performed first. Once the idle calibration is performed and accepted, the system will always suggest that the production calibration used.
The production calibration is done recurrently to recalibrate the tip as the tip wears and due to that the shape of the rotor plates wear. The time between calibrations will depend of the process and the normal wear of the plates. We suggest a calibration once a week until proven that the change is so small that the time can be increased.

The operator's role during the calibration is to supervise the process as long as the tip is moved toward the rotor. This is the most hazardous event of the process and if doubtful, the operator presses the HALT button to stop the movement.

The calibration procedure is designed to only save the TDC values at the different positions but not to change the valid calibration. The result of the calibration and the new gap value is instead presented to the operator whom will decide if to accept or to decline the calibration.
If accepted, the calibration will take affect and the gap value might be changed.

In a Metso RGP type refiner the procedure can be interrupted by the refiner interlocking logic.
A FeedGuard event will interrupt and also a GapGuard when the gap controller is active.
The procedure will also be stopped if any of the electronic unit alarms or if the movement of the tip slips (slip alarm).

If the tip has been moved from the home position (APO = 0.00 = flush with stator plates) the system will run the tip to home provided that the APO value is within 0.20 mm from the home position. The operator will be advised to run the tip to home if the distance is higher.

2 When and when not to calibrate

2.1 First calibration

The AGS must be calibrated when new plates or a new tip has been mounted. Both are usually changed at the same time to assure that the tip length and plate thickness matches.
The refiner logic must be changed so the plate gap can be lower than the plus and plus-plus limits. This is achieved by using the "Touch position switch" and running in local mode. Set to the on position (or CD / Flat for a CD-refiner) and move the plates together to about a 2.00 mm gap and then do an idling calibration of the tip.

2.2 Sequential calibrations

The following calibrations are normally done in production and repetitively after a tried-out period. Maybe once a week or after a rotation change. A normal figure is that the gap change should be

lower than 0.10 mm at each calibration. Consider a shorter period betweens calibration if the change is higher.

2.3 Gap controller blocking

The gap controller in the RMS system are blocked during the calibration but the GapGuard and the FeedGuard are active. It means that if the GapGuard or the FeedGuard is tripped, the calibration is stopped and the tip will return to the home position. Try again later.
You will be prompted if the gap controller is working when you try to start a calibration. Try again a couple of seconds later.

2.4 Plus/plus-plus logic

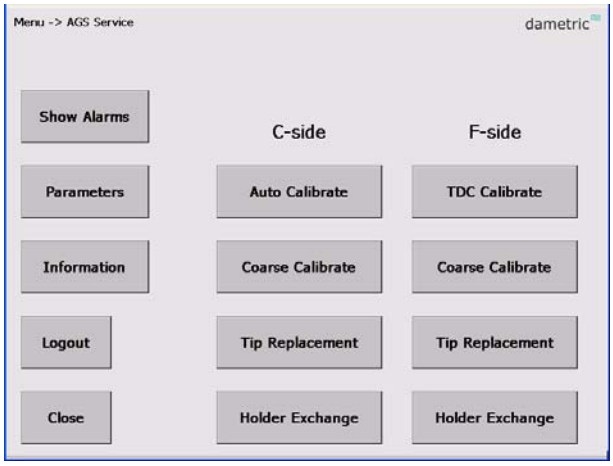
It not allowed calibrating in remote mode with the plus/plus-plus logic active. Since the gap value might change when the tip is moved toward the rotor, it might just pass one of the plus or plus-plus limits resulting in a rotor or stator position change. We want the rotor and stator to maintain in the same position during the calibration or otherwise the calibration result will be faulty.

2.5 Production stability

We advise that the operator checks the production stability before the calibration is executed. Open the trend form and watch the plate gap. If the gap is stable, go on with the calibration.
In case of an unstable gap with large fluctuations, consider to first lower the production to get a stabel signal and then perform the calibration.

3 AGS Service form

The AGS service form is reached by pressing the **MENU** button from the normal display form. The layout of this form will change for different kind of refiners so in a single disc/single stage refiner, only one column of buttons is shown.



3.1 Auto Calibrate

The Auto Calibrate button is used to start the calibration procedure of the selected sensor. This form is described in the following page.

3.2 Coarse Calibrate

This button is sometimes not shown and sometimes disabled (light grey text). The authorization level (login code) and the calibration status will determine the presence of this button. The function will coarse calibrate the sensor tip and thereby destroy the existing calibration values. Use only this button if a new sensor tip has been mounted and it is not calibrated with the refiner running.

3.3 Tip Replacement

The button will start a form which will help the service personnel to change the tip of the AGS sensor.
See the tip replace instruction (AGS-ServiceManual_Eng) for more details.

3.4 Holder Exchange

This button is used to help the service personnel to change the holder of the AGS sensor. The holder part is the mechanical part that connects the AGS house to the refiner. It is unique for each refiner type and is only changed if the thread is defective.

See the house exchange instruction (AGS-ServiceManual_Eng) for more details.

3.5 Information

The button presents some of the texts above on the screen.

The presence of the buttons in this form is determined by the authorization level (login code) and the calibration status.
The "***Operator***" level of login will allow the user only to do the **Auto Calibrate** function.
The "***Service***" level will disable the **Auto Calibrate** but enable the **Coarse Calibrate**, **Tip Replace**, **Holder Exchange** and **Parameters** buttons.
The "***Administrator***" level will allow all functions but must, of course, be used with more knowledge and understanding of the system.

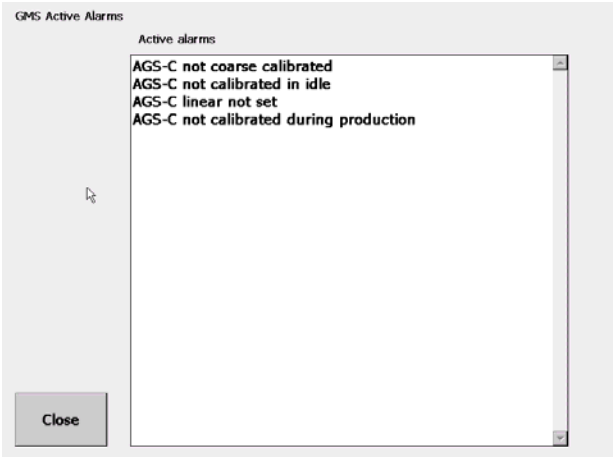
3.6 Parameters

Use the button to edit the calibration parameters.
The calibration related parameters is shown with a short description and the allowed max- and min values. Furthermore, the node from where the parameter belongs to is also shown. There is also a possibility to copy the parameter settings to a XML file for printing or archiving.
If two sensors are used in the system, the parameters for each side (node) can be turned on or off with the Node buttons.
To alter a parameter, do like this:

- Select the parameter by marking its name (a description of the parameter is shown at the top of the screen).
- Press the **EDIT** button and a new window with a key pad is shown.
- Enter the new value by using the key pad on the screen.
- Press the **SAVE** button. The program will give a warning if the entered value is outside its allowed range.

The parameter values are stored into a XML file when the **Save to file** button is pressed.

3.7 Show Alarms

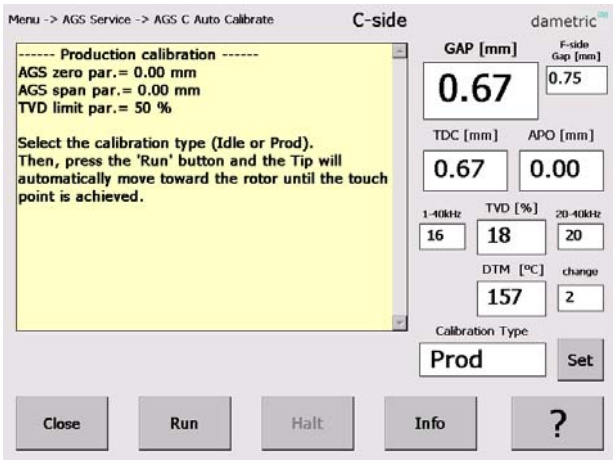


This button is only visible if an alarm is active in the system. Press the button and a text window will show the alarms for you. The following alarm messages are related to the calibration logic and can be seen if the AGS sensor is not fully calibrated.
"AGS-x not coarse calibrated".
The sensor is not coarse calibrated. This is done in the Tip Replacement procedure but can also be done manually. Log in as "Service" and press the Coarse Calibrate button in the AGS Service form.
"AGS-x not calibrated in idle".
The sensor has not been calibrated in idle mode. It means that the GAP reading is NOT reliable and therefore the refiner can not be put into production. Do an AGS Idle calibration to clear this alarm.
"AGS-x linear not set".
The linearity of the sensor is not optimized which is done in the idle calibration mode.
"AGS-x not calibrated during production".

The sensor has not been calibrated in production. It only informs the operator that this has not been done. It is normal to do the first production calibration after some 24 hours of operation so the refiner house and stand has reached its normal working temperature.

4 Auto Calibrate indicators and buttons

4.1 The text boxes



Text window – The flow of the process and the tasks for the operator will be presented.
GAP – The gap between the plates. This will remain almost constant during the process due it is the sum of the TDC and the APO. Some change is allowed since this is a re-calibration.
TDC – The distance between the tip and the rotor.
APO – The position of the tip. It is 0.00 when the tip is aligned with the stator plates.
TVD – The measured touch point level.
The **1-40kHz** indicates the TVD level within the full frequency band while the **20-40Khz** value indicates the TVD value in the upper frequency band. The TVD value in the centre box is a mix of the two vales and the mix can be changed a parameter.
DTM – The temperature measured inside the AGS tip. The "**change**" value will indicate the relative temperature since the calibration started. If the "change" value increases rapidly during the calibration it will probably mean that something is wrong. Push the **HALT** button and find out the reason.
Calibration Type – Indicates "PROD" or "IDLE". The IDLE type is the only alternative for the first calibration after a coarse calibration (coarse is done when the tip has been replaced). Once this is performed and accepted, the system will suggest that the PROD (production) calibration type is used. The user can switch between the types by the SET button.
New Gap value – This value will appear after the calibration is completed and it is now up to the operator to accept or decline the calibration result.

4.2 The buttons

Close – press this button to close the form.
Run – The procedure is started when the button is pressed. NOTE. Supervise the process once the button is pressed and until the touch point is reached. Do NOT leave the refiner panel in this state.
Halt – The button is seen as long as the tip is approaching the rotor. This will halt the tip movement temporarily and use the Run button to continue the movement. Once the touch point is detected the button will be hidden.
Stop – The STOP button is shown after that the touch point has been detected. If pressed now, the procedure will be stopped and the tip will be returned to the home position.
Info – Presents a text box on the screen that explains some of the text from this manual.
? – Press first this button and then a text box or a button and an explanatory text will appear.

The following buttons will appear later in the procedure:
Accept – Press this button if to accept the calibration result. See the "new Gap value" to check what the new gap value will be if the result is accepted.
Decline – Select this alternative if the calibration result is not within reason.
See later in this manual how to determine if to accept or to decline the calibration result.

4.3 Auto calibration procedure

This page will describe the flow of the procedure.

4.3.1 Start requirements

The procedure can not start until some requirements are fulfilled. The first requirement that is not fulfilled will appear in the information text.

- *"The AGS can not be calibrated due to a step motor slip alarm. Go back to the main menu and the alarm will be cleared."*
  The movement of the tip has slipped causing a slip alarm. Step back to the normal display form and the slip alarm will be cleared automatically. Then try again.
- "*The calibration can not start due to that the TVD level is too high (more than 75% of the cal. limit). Wait for a lower production level or check the settings.*"
  The TVD level is too high. The touch point is based upon a drastic change in the TVD level and if the start level is too high, the required change is not possible. Lower the production level or raise the TVD level for touch point (use the Parameters button from the AGS Service form.
- *"The calibration can not start because the TDC value is out of its calibration range (> 2.00 mm). Adjust by moving the rotor closer!"*
  The Gap value is higher than 2.00 mm. Close the plate gap so it is lower than 2.00 mm.

4.3.2 Idle calibration

The calibration logic will force the system to select the idle calibration is this is not done previously.

- The procedure is started when the Run button is pressed.
- The tip is moved toward the rotor.
  The TVD level is increasing when the tip starts to hit the rotor and when the TVD calibration limit is passed, the touch point is established. The system stores the TDC value as a zero calibration value.
- The tip is then moved out to the span position. This is the difference between the zero and span calibration parameters and is normally 1.00 mm. The speed of the tip is 0.25 mm/s so this takes about 4 seconds. The system will store the TDC value as the span calibration value after the TDC values has stabilized.
- The tip then moves to the linear check position which is the distance as the difference between zero and span positions, normally 2.00 mm. The TDC value is then stored.
  Finally the system will move the tip to the normal position which is aligned with the stator plates.
- The result of the calibration is presented to the operator as soon as the tip is in normal position. The operator decides if to accept or decline the calibration.
  The calibration result can be changed drastically if this is the first idle calibration after a coarse calibration, so the normal step is to accept the calibration.
- The system will then present the result of the linearity check. The normal measure is to accept the suggested change of linearity curves. If no change is needed, the system will tell you this.
- The calibration is then completed and the result can be seen in the **Calibration Log** which can be started from the **Menu** form.

4.3.3 Production calibration

- The procedure is started when the Run button is pressed.
- The tip is moved toward the rotor. The movement speed is determined of the measured TDC value and the touch point vibration value.
  The TVD level is increasing when the tip starts to hit the rotor and when the TVD calibration limit is passed, the touch point is established. The system stores the TDC value as a zero calibration value.
  The system will force a touch point if the TDC is less than -0.10 mm. This is a safe method to save the tip if, for instance, the TVD signal is lost without an alarm. This is noted in the text box if it happens.
- The tip is then moved out to the span position. This is the difference between the zero and span calibration parameters and is normally 1.00 mm. The speed of the tip is 0.25 mm/s so this takes about 4 seconds. The system will store the TDC value as the span calibration value after the TDC values has stabilized.
- Finally the system will move the tip to the normal position which is aligned with the stator plates.
- The result of the calibration is presented to the operator as soon as the tip is in normal position. The operator decides if to accept or decline the calibration.
  The calibration result should not be changed too much relative a previous idle or production calibration, so allow only small changes before the calibration is accepted.
- The calibration is then completed and the result can be seen in the **Calibration Log** which can be started from the **Menu** form.

4.3.4 Tip speed

The speed of the tip when finding the touch point is depending of the actual TDC value and the level of the TVD. The speed is highest at large gaps and a low TVD level and then decreases as the plate gap decreases and TVD level raises.
If the GAP value is less than 0.20 mm, tip speed = 0.02 mm/s
If the TVD value is higher than 50 % of the TVD limit, tip speed = 0.05 mm/s.
If the GAP is higher than 0.40 mm and TVD is less than 25% of limit, speed = 0.25mm/s.
If the GAP is higher than 0.20 mm and TVD is less than 25 % of limit, speed = 0.10 mm/s.

4.3.5 Accept or Decline

4.3.5.1 Indicators of the calibration result

The result of the calibration can be seen in the text window and in a text box that will appear once the calibration is completed.
Study the value in text box next to “If accepted, the new GAP will be:” because it will indicate what the gap will be if you accept the calibration. In the text window you can also see how much the TDC values was at the zero point “Zero value saved (TDC=0.00)” and the span point “Span value saved (TDC=1.00)”.
An example.
You are running at a constant gap of 0.50 mm and the result of the calibration is 0.60 mm.
If you accept this result, the new gap will be 0.60mm and the gap controller will soon move the plates together 0.10 mm to the set-limit value (0.50 mm).
If you are running at 0.50 and the new calibration result is 0.40, the plates will be moved apart 0.10 mm if you accept the calibration.

4.3.5.2 Idle calibration

The normal way is to always accept the idle calibration results. This is because we only use this calibration when we have a new tip that has been coarse calibrated. A coarse calibration means that the amplifier has been set to a fixed gain (1.00) and to a specific offset so the system will indicate 3.80 mm when there is no material in front of the sensor.
The result of the calibration will depend of the magnetic properties of the steel in the plates and also the plate pattern. The offset and gain values is designed so the TDC values at the touch point should normally be below 0.00 mm.
Note that the zero value can vary a great deal, values down to -3.00 mm or up to 0.50 mm can be seen.

4.3.5.3 Production calibration

Since the production calibration is a re-calibration it means that the alteration in the calibration result should not be fairly low relative to the last calibration. It is normal that changes less than 0.10 mm should be accepted. If the change is too high, you can always decline and try to calibrate again.

4.4 Calibration log

Sometimes it is useful to see the previous calibration. Go then to the Menu form and press the Calibration Log button. The last 200 calibrations are then listed.
You can se when and also the result of the previous calibrations.

5 TDC Mode

The user can select to run the RMS/AGS system in standard TDC mode. This is useful if there is an AGS sensor alarm that will disable the AGS calibration. The user can then do a standard TDC calibration by moving the rotor until it touches the stator plates. This prevents, of course, a calibration during production.
View the procedure in the “GmsCeAgs-Calibration-TDC_Eng” manual.

6 Abbreviations

CE ™. Operating system from Microsoft.

TDC - True Disc Clearance. Plate gap measured with a sensor placed in level with the stator segment.

AGS - Adjustable Gap Sensor. A TDC sensor with moveable tip which can be moved forward and backwards for calibration.

GMS – Gap Monitoring System. A measurement system for measure and presentation of the signals in a refiner, e.g. the plate gap and plate gap temperature.

RMS – Refiner Monitoring System. A measurement system for measure and presentation of the signals in a refiner, e.g. the plate gap and plate gap temperature for Metso type refiners.

DTM – Disc Temperature Monitor. The plate gap temperature measured inside in the plate gap with a TDC- or AGS sensor.

TVD – Touch point Vibration Detector. A measured value off the touch point signal between the disc plates. The signal is used to define the zero position (plate gap = 0) and is the basis of the zero calibration of a TDC- or AGS sensor.

APO – AGS Position. A signal for the position of the tip in an AGS sensor. It is zero when the tip is in level with the stator segment. The signal is increased when the tip is moved towards the rotor and decreased when it is behind the segment edge.

RPO – Rotor Position. A signal for the rotor axial position. (for LC refiners).

HPM – Hydraulic Pressure. A signal for hydraulic pressure for positioning of the stator in a Twin-60 refiner.

DCM – Disc Clearance Module. Measurement module for the plate gap and plate gap temperature.

ACM – AGS Control Module. Acts as a link between the AGS (Adjustable Gap Sensor) and the CAN-interface.

7 Documentation revisions

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