13. Troubleshooting and error guide

13.1 Flag guide

An error can occur occasionally, it is good to re-analyze the sample, do a prime cycle (for fluidic system error) or a cleaning to confirm if the error is persistent.
A flag can indicate an error, abnormal state, or warning for results. Some flags could be related to blood sample handling, pathological blood sample which are not due to analyzer system (instrument, reagents).
In table below, we list most possible corrective actions for each flag.

Flag	Message	Description	Action
AF (Aspiration failed)	Aspiration failed, check sample. Signal from Blood detector in shear valve.	Possible reasons for AF flag include a short sample, clogging or air bubbles in sample tube; blood deposition in shear valve pipe decreased blood detector sensitivity; weak aspiration vacuum from waste pump **Note:** This flag is also displayed when running a background count (blank) without selecting the background analysis profile.	Check profile type is correct and then re-analyze sample. Run a Boule cleaning kit procedure (cleaning with hypochlorite). Check/replace waste pump. Sensitivity of blood sensor in shear valve decreases due to organic deposit, manual cleaning of shear valve with wire, then flush with syringe filled by hypochlorite. Test blood detector by passing diluent through shear valve with syringe and see detector response in service menu.
Distribution Indicators (RBC, PLT, WBC)			
Indicator	**Message**	**Description**	**Action**
DE (Distribution error)	Small particle interference; re-analyze; Abnormal distribution visible from histogram	The size distribution of the cell pulses departs from the expected one. Possible reasons might be pathological blood sample (e.g. nRBCs), PLT clumps, air bubbles, electrical disturbances, incomplete lysing or incorrect gain setting (most common with WBC). **Note:** run control blood with human profile will show DE in WBC.	Re-analyze sample. Check if control blood is run as human profile; Check histogram for abnormal shape/shift, noise test; Check gran-top (WBC histogram shift) if DE in WBC, adjust WBC gain; Check/replace Lyse (control blood result can be ok but DE shows on human blood result); Check preanalytical factors.

FD (Fixed discriminator)	RBC/PLT: PLT Irregular Distribution, re-analyze	It was not possible to find the correct position for the floating RBC/PLT distribution curve. This flag often occurs on low PLT counts. The FD flag should only be reported if the corresponding parameter (PLT) value is high enough.	Re-analyze sample. Inspect histogram, no separation between PLT and RBC;
HGB Indicators (HGB) **All H- flags from HGB module, check HGB menu and photocell voltage should be close to 3500. Make sure HGB module firmly fit on WBC chamber, adjust HGB gain to 3500.**			
Indicator	**Message**	**Description**	**Action**
HF (HGB flucturation)	HGB Measuring Problem – run prime cycle	The instrument detected a problem during the filling of liquid in WBC counting chamber during HGB blank. Turbulent filling of WBC chamber after counting step	Run a "Prime cycle", before re-analyzing the sample. Add restriction to v25 (many instruments already have) Change HGB filling setting to Method 2 to make HF less sensitive (sw > 2.3 for BM850, 3.1.1 BM800)
HH (HGB high)	HGB Measuring Problem – run prime cycle	The HGB blank or sample readings reported a too high light level.	Check HGB gain setting; Check liquid level in WBC chamber, use high altitude compensation to bring level higher.
HL (HGB low)	HGB Measuring Problem – run prime cycle	The HGB blank or sample readings reported a light level that was too low.	Check HGB gain setting; Check liquid level in WBC chamber, use high altitude compensation to bring level higher.
HN (HGB negative)	HGB Measuring Problem – wait one minute then re-analyze	The HGB sample reading reported more light than the blank reading. This gives a negative HGB value.	Wait one minute, and then re-analyze sample. Check HGB gain setting; Check liquid level in WBC chamber, use high altitude compensation to bring level higher.
HO (HGB offset)	HGB Measuring Problem – restart system	The HGB dark (offset) reading reported a light level that was too high or too low.	Switch off the analyzer and switch it back on after 3 seconds, and then re-analyze sample.
HS (HGB saturation)	HGB Measuring Problem – run prime cycle	Individual HGB readings vary too much.	Run a "Prime cycle", before re-analyzing the sample.
Note: If various HF, HH, HL, or HN Indicators repeatedly appear check High Altitude Compensation, mode may need to be changed to Moderate or Maximum compensation in higher elevations, or simply bring filling level higher.			

Measuring Chamber Indicators (RBC, PLT, WBC)			
Indicator	**Message**	**Description**	**Action**
OR (Cell counting overrun error)	Measurement warning – re-analyze. From impedance measurement (aperture, signal collection)	The cell pulses arrived faster than the analyzer could process them. Possible reasons might be air bubbles, electrical disturbances or incomplete lysing. **Note:** Filtered away cell pulses might raise the OR flag, so it might not be possible to see	Re-analyze sample. Check noise test for electrical interference; orifice failure (replace measurement chamber);

		them in the histograms or the result parameters. This is a hard limit determined by the software.	
SE (statistical error)	Measurement Statistics Warning; re-analyze	The rate of cell pulses per time unit varies too much. Possible reasons might be clogging, air bubbles, electrical disturbances or difficult to lyse cells. **Note:** Filtered away cells might raise the SE flag, so it might not be possible to see them in the histograms or the result parameters.	Re-analyze sample. Check noise test; Check membrane pump leakage; leaky v4 (for WBC) or leaky v3 (for RBC) produce similar effect as leaky membrane pump; Check/replace aperture/chamber; Check preanalytical factors.
Mixing Beaker Indicators (RBC, PLT, WBC)			
Indicator	**Message**	**Description**	**Action**
TE (transfer error)	Liquid System Problem – run prime cycle. From beaker detector.	The analyzer detected an abnormality during the emptying of the first dilution from the mixing beaker. Reasons for flagging might be timeout, or too short of a transfer time. The process shows on page 11" prepare for second dilution" in flow diagram.	Run a "Prime cycle", before re-analyzing the sample. Check the whole segment involved on page 11, from ventilation via v28, mix beaker, shear valve pipe 7/9, v24, WBC chamber, waste pump vacuum capacity, waste tubing to sewage.
Reagent and Control Indicators (RBC, PLT, WBC, LYM/MID/GRAN) **User related, need to input valid lot. number of reagents and control blood**			
Indicator	**Message**	**Description**	**Action**
EC	Expired control	A control blood was used past its expiry date.	Use a fresh blood control
ER	Expired Reagent	The reagent was used past its expiry date. Change to a non-expired lot of reagents.	Use a new lot of reagents
NR (No reagent)	Not enough reagent left, check reagent levels. All reagent cycles consumed before expiry	The analyzer's capacity counter has gone below zero and no reagent is detected. Reason for no reagent may include empty reagent container or reagent level sensor not inserted correctly into reagent container	Check reagent levels impedance sensor. Input a new reagent pack
Reagent Pipette Indicators (RBC, PLT, WBC)			
Indicator	**Message**	**Description**	**Action**
DF (Diluent pipette fill error)	Diluent system problem – run prime cycle. Signal from volume detectors on Dis1 diluent pipette	The instrument detected an abnormality during one of the fill cycles of the diluent pipette. Reasons for flagging might be timeout, short time or bubbles at the upper detector. Fill dis1 pipette with diluent from reagent container via inlet valve, v22/ v20, v5, liquid filter by waste pump	Verify instrument is filled, run a "Prime cycle" and then re-analyze sample. Weak vacuum from waste pump, even clogged waste tubing out instrument to sewage; Check silicon tubing for pinch/stop under valves, especially instrument has been in storage without proper shut down
DP (Diluent pipette	Diluent system problem – run prime cycle.	The instrument detected an abnormality during one of the empty cycles of the diluent pipette. Reasons for flagging might be	Verify instrument is filled, run a "Prime cycle" and then re-analyze sample.

empty error)	Signal from volume detectors on Dis1 diluent pipette.	timeout, short time or liquid not detected at the lower detector.	Empty Dis1 pipette by pressure from air pump during 1st and/or 2nd dilution steps; Check silicon tubing for pinch/stop under valves, especially instrument has been in storage without proper shut down; Check tubing segment for 1st and/or 2nd dilution steps, air pump, via v9, v17 (1st dilution), 2nd dilution via shear valve (pipe 7/9) to RBC chamber, ventilation of BC chamber via v3.
LF (Lyse pipette fill error)	Lyse system problem – run prime cycle. Signal from volume detectors on Dis2 lyse pipette. LF Corresponding for DF but much less often	The instrument detected an abnormality during the fill cycle of the lyse pipette. Reasons for flagging might be timeout, short time or bubbles at the upper detector.	Verify instrument is filled, run a "Prime cycle" and then re-analyze sample. Check silicon tubing for pinch/stop under relevant valves, especially instrument has been in storage without proper shut down; Lyse dis2 pipette filling after 2nd dilution via inlet valve, check reagent leaky connector on back chassis
LP (Lyse pipette empty error)	Lyse system problem – run prime cycle. Signal from volume detectors on Dis2 lyse pipette. LP corresponding to DP but much less common	The instrument detected an abnormality during the empty cycle of the lyse pipette. Reasons for flagging might be timeout, short time or liquid not detected at the lower detector.	Verify instrument is filled, run a "Prime cycle" and then re-analyze sample. Check silicon tubing for pinch/stop under valves, especially instrument has been in storage without proper shut down; Check 2nd dilution via v21, v24, v13 to WBC chamber; If LP only shown after longer time standby (first cycle after overnight standby), it could be liquid level getting lower of top volume detector during standby due to leaky lyse inlet valve, air bubble in measuring tube, etc.

Reagent Pipette Indicators (RBC, PLT, WBC)			
Indicator	**Message**	**Description**	**Action**
ST (Short counting time error)	Air bubbles – run prime cycle. Signal from volume detectors on measuring tubes M1 and/or M2.	The time for the liquid meniscus to pass from the lower to the upper detector is unreasonably short. Maybe one big air bubble or measuring tube filled to fast	Run a "Prime cycle", before re-analyzing the sample. Normally liquid in tubing between measurement chamber and measuring tube (RBC MC1 and M1; WBC MC2 and M2) just moves back and forth during a cycle, air bubble can not get

			into this part of tubing, first check if prime cycle can restore to normal state, then check how air bubbles get into this part of tubing .
TB (Tube bubbles error)	Air bubbles – run prime cycle. Signal from volume detectors on measuring tubes M1 and/or M2.	Air bubbles were detected by the start detector in the measuring tubes. More than one liquid surfaces are detected by volume detectors, as air bubbles inside measuring tube	Run a "Prime cycle", before re-analyzing the sample. Normally liquid in tubing between measurement chamber and measuring tube (RBC MC1 and M1; WBC MC2 and M2) just moves back and forth during a cycle, air bubble can not get into this part of tubing, first check if prime cycle can restore to normal state, then check how air bubbles get into this part of tubing. One possibility is ventilation to measurement chamber is stopped.
TL (Timeout Lower detector)	Possible orifice blockage: Run prime cycle and then re-analyze. Signal from volume detectors on measuring tubes M1 and/or M2.	The liquid meniscus in the measuring tube never passed the lower detector.	Run a "Prime cycle", before re-analyzing the sample. Check aperture clogging if TL/TU in WBC, run 2% hypochlorite from Boule cleaning kit as pre-dil sample (recommended in User manual for monthly cleaning procedure); Check v15 (RBC), v26 (WBC) from service menu/pump and valve test; Check membrance pump for leakage; Check measurement chamber ventilation, if ventilation is stopped, trapped vacuum may offset the pressure, among raising other failures.
TU (Timeout upper detector)	Possible orifice blockage: Run prime cycle and then re-analyze. Signal from volume detectors on measuring tubes M1 and/or M2.	The liquid meniscus in the measuring tube passed the lower detector but never passed the upper one.	Run a "Prime cycle", before re-analyzing the sample. See above TL section.
WBC Differential Abnormalities (LYM, MID, GRAN) **WBC Diff flags related to histogram shape, abnormal subpopulation distribution, most common preanalytical factors or old sample**			
Indicator	**Message**	**Description**	**Action**
BD (bad distribution)	WBC DIFF: High interference between populations.	The calculated populations for LYM, MID, GRAN overlap too much. Often in pathological samples with granulocytosis or lymphocytosis a blood smear is recommended.	Check WBC histogram shape, ask user to send result with histogram;

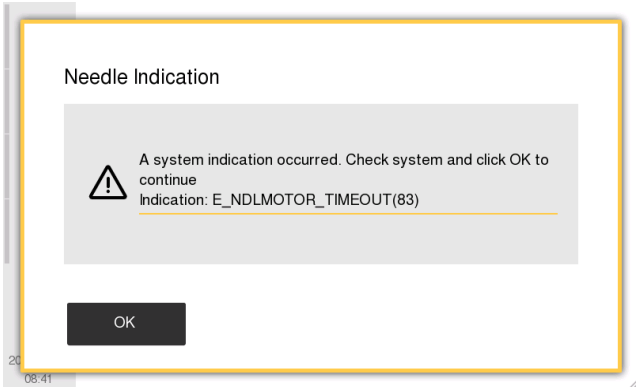
NM (no mode/peak)	WBC DIFF: No WBC population found; slide review advised.	There was no mode in the WBC distribution between the LYM-L and GRAN-H settings.	Check fresh control blood result and histogram; Preanalytical factors, Blood sample too old or pathological sample. Slide review advised.
OM (one mode/peak)	WBC DIFF: Only one WBC population found; slide review advised.	There was only one mode in the WBC distribution between the LYM-L and GRAN-H settings. Often in pathological samples with granulocytosis or lymphocytosis a blood smear is recommended.	
TM (too many peaks)	WBC DIFF: Too many WBC population found; slide review advised.	There were more than two modes in the WBC distribution between the LYM-L and GRAN-H settings.	

13.2 Indications / error-codes

Indications or error-codes are specific instrument situations that in most cases need the attention of the operator and might need service action. This section describes the Indication numbers as well as the recommended action to be taken. The last Indications are logged and can be retrieved by doing a P.I.L. (Print Instrument Log, see Section 8).

In most cases, the BM850 is stopped, and the operator has to confirm with [OK] to continue.

Indications are grouped to simplify communication between the user and service staff.



Indication with number

Some indications can occur due to user errors, and in those cases the indication number might not be shown in the dialogue. It can still be found in the Instrument log, however.