User Manual 001878

2.125” K-Set Setting Tool

Revision 3

September 16 2019

Revision	Date	Comment	Author	Checked	Approved
1	May 17, 2019	Released	G Smith	P Church	P Church
2	July 15, 2019	Software update revisions. Addition of Extended Length K-Set	G Smith	G Smith	G Smith
3	September 16, 2019	Correction made to Table 3 (Full Stroke is 16” not 10”)	G Smith	G Smith	G Smith

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1 Introduction and specification

1.1 Overview

A Setting Tool is used in the running, placement, setting, and potential retrieval of multiple wellbore devices (e.g. Isolation Barriers. Bridge Plugs, Packers, Sleeves, Anchors etc.). The **kaseum** Setting Tool product line, or '**K-Set**', is a modular, electro-mechanical Setting Tool used in the deployment of such wellbore devices.

The **K-Set** product line currently comprises of three setting tool sizes, they are:

- 3.6" OD tool with nominal pulling force of 60klbs and 9.5" of stroke.
- 2.75" OD tool. There are currently two variants of this tool OD size. They are:
    - Non-Perforating variant, with nominal pulling force of 40klbs and 10" of stroke.
    - Perforating variant, with nominal pulling force of 30klbs and 5.5" of stroke.
- 2.125" OD tool. There are currently two variants of this tool OD size. They are:
    - Standard Length variant, with nominal pulling force of 30klbs and 10" of stroke.
    - Extended Length variant, with nominal pulling force of 30klbs and 16" of stroke.

Figure 1 – 2.125" OD K-Set exploded view

The function of a Setting Tool is to apply linear differential movement to allow a wellbore device to be deployed in its un-set state, then once at the target depth and commanded by the user, is activated to set, or 'pack-off', anchoring them into the wellbore.

The **K-Set** has a non-hazardous design, utilizing alkaline battery power instead of pyrotechnic or Lithium and does not require hydraulic fluid. The **K-Set** is electronically controlled and can be used in both Surface Read Out (i.e. real-time) and Memory Mode, providing multiple methods of activation along with the option of real time command and control. Once the setting cycle is commanded the tool provides a slow, controlled axial movement which aids in the centralization of the wellbore device, and can easily achieve the high loads required to shear off the device once it is set into the wellbore, thereby allowing recovery of the **K-Set** and conveyance string. The **K-Set** has onboard measurement data which can be transmitted to the surface in real-time, or can be stored in flash memory for post-job analysis. Once back at surface the **K-Set** can be electronically 'Reset' without the need for mechanical disassembly, allowing for faster turnaround times, reduced risk of operator error, and no need for specialist technician training.

This user manual describes the function and use of the 2.125" OD **K-Set**, both Standard and Extended length.

1.2 Features

K-Set is a step change in setting tool technology, offering unrivalled safety, cost, flexibility and reliability:

- **Non-Hazardous, Non-explosive**. The **K-Set** uses alkaline batteries as the power source, which are non-hazardous and can be shipped unrestricted worldwide, unlike its explosive or Lithium powered counterparts.
- **No internal hydraulic system**. The electro-mechanical design of **K-Set** contains no hydraulics or internal pressurised chambers, hence there is decreased risk to operating personnel as there is no trapped pressure on return to surface and no hydraulic service kit is required.
- **Unaffected by cumulative shock to electronics**. One of the biggest failure modes of downhole electronic systems is cumulative temperature and shock cycling. The **K-Set** utilizes a single-use electronic controller (The “PCM”) which virtually eliminates these failure modes.
- **Industry standard mechanical connections**. The **K-Set's** mechanical connections mirror that of other Setting Tools on the market, making it possible to use existing legacy Setting Adaptors.
- **Electronic control**. The setting cycle is initiated and controlled electronically for increased accuracy.
- **Modular design**. The modular design of **K-Set** allows for ease of maintenance for the life of the tool. It also provides flexibility to quickly alter and reconfigure the **K-Set** to adapt to specific operator requirements (i.e. the stroke length can be increased/decreased by changing one sub assembly only, the setting speed can be increased/decreased by changing only one sub assembly) without the need for completely new setting tools.

1.3 Physical Properties

Table 1 - Common physical properties of the 2.125" K-Set Standard and Extended length

Maximum OD	2.125" (54mm)
Top Thread Description	E-Line: 1-3/16 x 12 UN (GO) Box Slickline: 1-1/16" x 10 UN (Sucker Rod) Pin
Upper Fishing Neck	Size 2-1/2" Fishing Neck: 1.740" (44.2mm) Major OD 1.500" (38.1mm) Minor OD
Maximum Operating Pressure	15,000psi (1034bar)
Minimum Operating Temperature	14°F (-10°C)  The PCM will not perform at full capacity when at this temperature. It is advised to keep the PCM at room temperature for as long as possible prior to operation.
Maximum Operating Temperature	275°F (135°C) for 6 hours 250°F (121°C) for 8 hours  Exposure to temperatures greater or longer than stated **WILL** cause battery leakage, and may damage internal components
Nominal Setting Force	30,000lb (13.61 Tonne)
Maximum Setting Force	40,000lb (18.14 Tonne)
Maximum Tensile Rating	E-Line: 25,000lb (11.34 Tonne) at GO Box thread Slickline: 30,000lb (13.61 Tonne) at SR thread
Outer Adaptor Thread Description	2" x 10 Stub Acme Pin (Owen MSST)
Inner Adaptor Thread Description	0.6875" (11/16") x 16 UN Box Thread (Owen MSST)

Table 2 - Physical properties of the 2.125" K-Set Standard length

Overall Length	E-Line: 56.93" (1446mm) Slickline: 57.92" (1471mm)
Make Up length	E-Line and Slickline: 50.38" (1280mm)
Tool Weight	34.2lb (15.5kg)
Stroke Length	10" (254mm)
Maximum Time for Full Stroke (10" Travel)	17 minutes

Table 3 - Physical properties of the 2.125" K-Set Extended length

Overall Length	E-Line: 68.93" (1751mm) Slickline: 69.92" (1776mm)
Make Up length	E-Line and Slickline: 62.38" (1584mm)
Tool Weight	42.3lb (19.2kg)
Stroke Length	16" (406mm)
Maximum Time for Full Stroke (16" Travel)	26 minutes

1.4 Electrical Properties

Table 4 - Table of PCM electrical properties

Number of Cells in Battery Pack	48
Voltage Output of Battery Pack	36V
Battery Pack Capacity	2.54Ahr
Electrical Connection to Motor	4 x 4mm Banana Connections in oriented Contact Cap.
Countdown Timer Current Consumption (Slickline Mode)	10mA
Current consumption when transmitting Data (SRO Mode)	20mA
Nominal Current Consumption (No Output Load)	300mA to 1000mA
Maximum Instantaneous Current Consumption	8A
PCM Log Data Storage Capacity	16Mb (Approx. 1M datasets)
Maximum Line length for SRO Mode	25 000ft* (see Warnings below)

Warning. Due to the wide variation of wireline logging cables and their electrical characteristics, correct operation of the **K-Set** SRO communications should be verified on each cable prior to RIH.

Warning. It is NOT recommended to use a shooting CCL or a powered correlation device when using the **K-Set** in SRO mode as these may affect the transmission and receiving of tool communications. If a correlation device is to be used then a non-powered correlation CCL (i.e. a logging CCL without internal diodes) is recommended. This CCL should be function checked in the string prior to R.I.H to ensure there is no communication with the **K-Set.**

The **K-Set** can be used to record data from a 'Shooting' or 'Logging' CCL in Memory Mode for post run correlation analysis. It is recommended to use the shooting CCL upside down to negate any interference from the internal diodes of the shooting CCL.

Table 5 - Table of PCM monitored channels

Channel Description	Range Min	Range Max	Units
CCL	0	3299.19	mV
Motor Current	0	8.25	Amps
Battery Voltage	0	52.79	Volts
Op Mode and array index	0	510	N/A
Z axis Accel	-15970.50	15970.50	mg
Pulse number	0	7	N/A
CCL Deviation	0	3299.19	mV
X Axis accel	-15970.50	15970.50	mg
Y Axis accel	-15970.50	15970.50	mg
Temperature	-50	279.92	°C

2 Operational Safety and Warnings

Alkaline battery cells. The **K-Set** uses primary (i.e. non-rechargeable) alkaline (Alkaline Manganese, AlMn) cells for the provision of power. These are the most common battery cells sold worldwide. Battery cells should be disposed of correctly according to local regulations.

The battery cells are housed within the PCM of the **K-Set**. The user should:

- **NEVER** crush, grip or puncture the PCM.
- **NEVER** dispose of the PCM in common waste or in a fire/furnace.
- Store the PCM in a cool dry atmosphere (ideally between 10°C and 25°C and less than 65% humidity) to maximize the battery cell life.
- **NEVER** attempt to charge the battery cells. The cells used are primary cells and **MUST NOT** be recharged. Attempting to recharge a primary cell may lead to leakage and possible explosion.

Alkaline cell leakage. If the battery cell is overheated or overloaded, or the integrity of the battery cell is compromised due to being crushed/taken apart/punctured etc. then the user may be exposed to harmful materials within the battery cell. The internal battery cell contains the following hazardous materials:

Signs of battery leakage will be evident when removing the PCM Housing post run.

- If pressure is present in the PCM Housing connection then set tool aside and allow time for the pressure to escape. After the tool has been left for a period of time unscrew the PCM Housing enough to unseat one O-ring and allow any pressure to vent naturally, then continue to unscrew and unseat the second O-ring. Once all pressure has bled off, remove the PCM Housing and whilst wearing the correct PPE (gloves and safety glasses as a minimum), place the PCM in a bag of vermiculite and dispose of as per local regulations.
- If a white salt like residue is present on the PCM then this is also an indication that the cells may have leaked. Again, whilst wearing the correct PPE, place the PCM in a bag of vermiculite and dispose of as per local regulations.

Atmospheric Chamber. The **K-Set** internals are an atmospheric chamber, meaning the internal cavity is not pressurised. If the **K-Set's** seal integrity is compromised when in a pressurised environment (i.e. downhole) then there is the possibility that the tool may return to surface with trapped pressure inside. If when removing the PCM Housing the connection is found to be tight then this may indicate trapped pressure. The **K-Set** should be quarantined and set aside for a period of time to allow the pressure to vent. Once the connection becomes free, slowly unscrew the connection until the O-rings are unseated and this should release any remaining trapped pressure that may exist inside the **K-Set**.

Manual Handling. When fully assembled the **K-Set** presents a manual handling risk for a single user due to its size and weight. Use mechanical aids whenever possible or seek assistance from additional personnel in the movement and manoeuvring of the **K-Set**.

Handling Risks. The **K-Set** is round and will roll on a flat surface, ensure that the **K-Set** is stable and secure when placed on flat surfaces.

Handling Risks. When the **K-Set** is retrieved from deployment it may have handling dangers present (i.e. it can be hot and may present marking/abrasive surfaces due to the nature of the environment it is used in.) Always wear gloves when handling the **K-Set** as a minimum, and adhere to any local or company handling policies.

Pinch Points. Due to the nature of the **K-Set** setting cycle, a pinch point may exist at the lower end of the tool. The user must take all precautions necessary to ensure that the pinch point is identified and that the tool is always functioned in a safe environment where there is no risk of the pinch point causing a safety risk.

Arming Code. In Memory Mode the **K-Set** protects against power glitches by means of an electronic arming code. This arming code is detected when the Memory PCM is initially connected to the **K-Set** main tool assembly. Once detected this arming code is electronically read and deleted, and the **K-Set** will operate as programmed. If there is a power glitch, or the Memory PCM is removed from the **K-Set** main tool assembly and re-attached, this arming code will not be present during the initialization sequence and the **K-Set** will not operate. The user must always ensure that the Memory PCM is not fitted and removed multiple times before the operation, and that a valid diagnostic LED signal is observed prior to deployment.

Maximum Running Speed. The maximum recommended running speed for the **K-Set** is 150ft/min or 50m/min. Running the tool faster than this may cause unnecessary damage or shock to the tool.

Tensile Rating. The maximum tensile rating of the **K-Set** is 25,000lb at the GO Box Thread if using PCM Housing E-Line, or 30 000lbs at Sucker Rod Pin Thread if using the PCM Housing Slickline.

Left Hand Threads. A single left-hand thread is used between the Gearbox Module and the Linear Actuator Module of the **K-Set**. All other threads are right hand threads.

Software Installation. The files and folders created during the installation of software should not be amended in any way. Changes to these files or folders will cause errors and will not allow the Memory PCM to be programmed. If any changes are required please contact info@kaseum.com.

Lithium-Ion Batteries. The **K-Set** Surface Interface uses rechargeable Lithium-Ion Batteries as a power source. Ensure that the only the supplied, approved charger is used for charging the Surface interface and always charge in an environment with a temperature greater than 4°C. Ensure that the unit is kept in good condition and is not exposed to water or fluids.

If in doubt about the operation, function or use of the K-Set then STOP and seek assistance.

3 K-Set Design Overview and Principle of Operation

The **K-Set** is governed by an electronic controller that outlines the operational parameters of the setting process. Once a setting command has been acknowledged by this controller then the setting cycle will commence. The power is supplied from the alkaline battery pack and is routed to a small DC motor, which provides a high speed, low torque input into a Gearbox. The Gearbox takes this high speed, low torque input and generates a low speed, high torque rotational output. This rotational output is coupled to a Linear Actuator mechanism, which converts the rotational movement to linear movement, and in turn pulls the Slick Rod slowly upwards.

When the **K-Set** is connected to a wellbore device, this linear movement of the Slick Rod will allow the device to be expanded into the wellbore in a controlled manner. Once the device is set into the wellbore the **K-Set** will continue to pull and to then disengage the release mechanism of the wellbore device, leaving it in-situ, whilst allowing the **K-Set** and the conveyance medium to be retrieved to surface.

Once back at surface, the **K-Set** can be commanded to 'Reset' back to its starting position electronically, ready for additional deployment in minutes.

The **K-Set** comprises of four modular sub-assemblies. From the uppermost to lowermost they are:

- Power and Comms Module (hereby referred to as 'PCM') assembly
- Motor Module
- Gearbox Module
- Linear Actuator Module

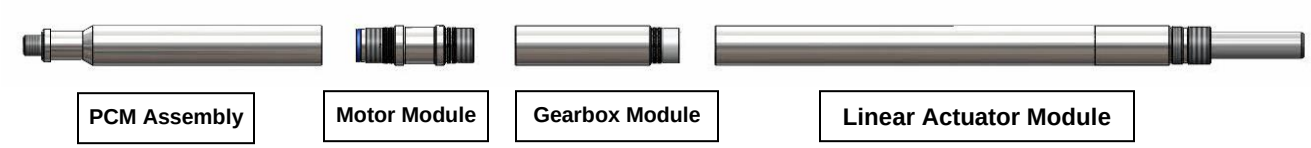


Figure 2 - Exploded modular view of K-Set

The **K-Set** has been designed with operator ease of use, reliability and low cost at its core. The PCM utilizes a single use power source and electronic controller, which eliminates the risk associated with cumulative electronic shock cycling, and ensures that a new power source is available for each setting cycle. The design of **K-Set** ensures that minimal redress and maintenance is required between operations, and that this maintenance can be conducted by a single individual with no specialized training. This allows for faster turnaround times and greatly reduces the margin for human error.

The following section gives a more detailed breakdown of each of the four modular sub-assemblies.

3.1 PCM Assembly

The PCM Assembly consists of two main parts, the PCM Housing and the PCM.

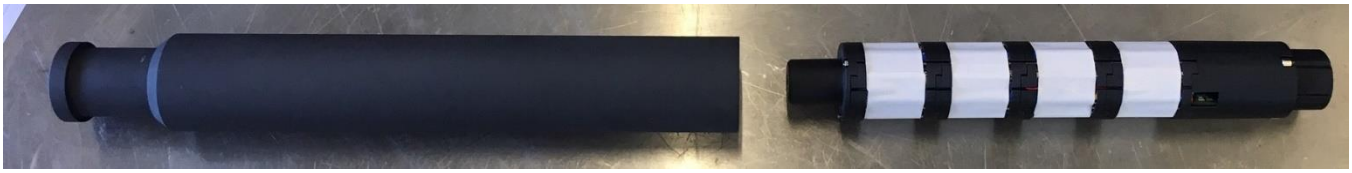


Figure 3 - PCM Assembly constituent parts from left to right: PCM Housing, PCM

The PCM houses the alkaline battery power source and electronic controller that govern all aspects of the setting tool. There are 2 variants of PCM that can to be used, they are:

- Memory Mode PCM (**kaseum** part number 001199) with PCM Housing Slickline (**kaseum** part number 001205)
- SRO Mode PCM (**kaseum** part number 001200) with PCM Housing E-Line (**kaseum** part number 000637).

USER CAUTION. The PCM is not interchangeable between Memory Mode and SRO Mode. This is intentional to guard against a Memory Mode PCM with a programmed Countdown Timer being used for an SRO operation. Ensure that the correct type of PCM is selected for the type of operation to be carried out.

An SRO PCM cannot be programmed for Memory Mode operation and vice versa.

Regardless of whether the PCM is Memory Mode or SRO Mode, the run data will always be logged and stored to the onboard flash memory, which can be downloaded later for analysis and confirmation of operation success.

3.2 Motor Module

The Motor Module is a simple assembly consisting of a DC motor, shock mounted within an Outer Motor Sub. The top of the Outer Motor Sub has an oriented electrical 4 pin Connector Plate for make up with the PCM. The bottom of the Outer Motor Sub has a spring-loaded, self-aligning coupling which connects the output of the Motor to the input of the Gearbox.

Figure 4 - Motor Module. Left: Top View, Right: Bottom view

3.3 Gearbox Module

The Gearbox Module is a custom designed Gearbox. The robust design ensures that repeated high loads can be generated without deterioration of operation. The Gearbox Module takes the high-speed rotational motion of the motor and converts it to high torque output which is directly coupled to the Linear Actuator Module.

Figure 5 - Gearbox Module

3.4 Linear Actuator Module

The final module in the **K-Set** is the Linear Actuator Module. The Linear Actuator Module converts the rotary torque from the Gearbox Module into a linear pulling force. The Linear Actuator output is via the Slick Rod, which is the dynamic part of the **K-Set**. Once running, the Slick Rod will slowly travel upwards providing the differential movement required to set the wellbore device and generate the force require to disengage the **K-Set** and conveyance medium from the wellbore device. There are 2 variants of Linear Actuator Module that provide different lengths of available stroke during they setting process. They are:

- Standard Length, **kaseum** part number 000957. This allows up to 10" of setting stroke.
- Extended Length, **kaseum** part number 001436. This allows up to 16" of setting stroke

Figure 6 - Linear Actuator Module

There are several functions and operations that a user must be able to execute and understand in order to successfully deploy the **K-Set** and be deemed competent in its use. They are:

- **Identification and familiarization of the K-Set parts**. In order to operate the **K-Set,** it is important that the user understands the fundamentals of the tool, what each part is, and its function.
- **Programming a PCM (if using in Memory Mode)**. The PCM is the main controller of the **K-Set** and it must be programmed by the user prior to every Memory Mode run; therefore, the user must ensure that they are competent in this operation.
- **Surface Testing the K-Set**. The **K-Set** can be surface tested in order to ensure it is working correctly. This should be carried out regularly by the user, Kaseum recommends a Surface Test prior to every run.
- **Resetting the K-Set**. After a setting cycle the **K-Set** must be electronically 'Reset' back to its '*Ready to Run*' position.
- **Understanding the logged data**. During a setting cycle the PCM will log data from the onboard electronics. This data can be used during the run (if using SRO Mode) or analysed later for confirmation of a successful deployment.
- **How to re-torque K-Set connections that have broken out**. During normal use of the **K-Set** only the PCM Housing needs to be removed for use. If any of the other **K-Set** connections become un-torqued then the user must know the correct procedure for redressing and re-torqueing the tool.
- **Routine and periodic maintenance**. The **K-Set** must be inspected and maintained to a good standard to ensure the tool remains fit for function throughout its lifecycle.

These functions are explained in greater detail in the following sections

4 Part Identification and Familiarization

In order to successfully function the **K-Set**, the user should first familiarize themselves with the following parts and their specific function:

4.1 PCM Housing

The PCM Housing is the only external pressure Housing that needs to be removed and re-fitted during operational field use. There are two PCM Housings that can be used depending on the operation type. They are:

- PCM Housing Slickline (**kaseum** part number 001205). This Housing has a 1-1/16" UN Pin thread at the top.
- PCM Housing E-Line (**kaseum** part number 000637). This Housing has a 1-3/16" GO Box thread at the top.

Both PCM Housings have an industry standard Size 2-1/2" fishing neck. The lower thread on the PCM Housing is 1.830" Stub Acme (common to all 2.125" **K-Set** Pressure Housings and Pressure Subs). When making up and breaking out the PCM Housing connection the user should always use the Motor Module Housing as a backup point, and tighten the thread to a minimum of 100lb.ft. This connection, like all main body connections of the **K-Set**, uses a metal to metal sealing angle to protect the standard dual elastomeric and Back-Up seal, so it is important that this minimum torque figure is adhered to.

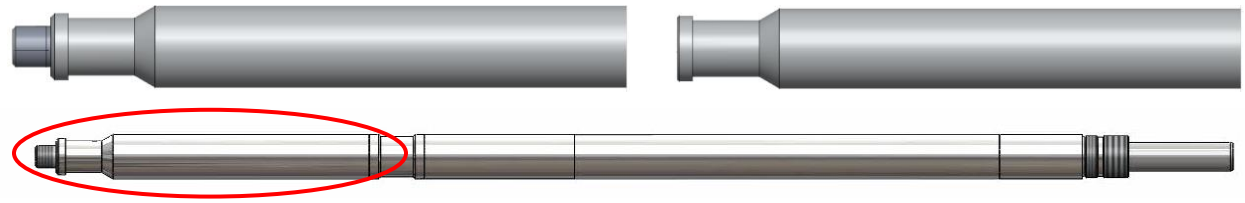


Figure 7 - PCM Housing images, Slickline on the top left and E-Line on top right, and location in refence to the complete K-Set

4.2 PCM

The PCM is the single most important component for the field user. The PCM is the power source and electronic controller of the **K-Set** and it must be programmed (if using Memory Mode) and fitted correctly.

The PCM is a single use item and should not be run more than once. Note: the PCM is designed with enough redundancy to carry out 1 x deck test, 1 x full stroke job (max 12hrs in hole) and 1 x 'Reset'

The PCM is filled with alkaline battery cells, therefore it is important that the PCM is not gripped/clamped/punctured/pierced or mishandled.

There are two types of PCM's available depending on the operation type to be carried out. They are Memory Mode and SRO (or E-Line) Mode. These PCM's are not interchangeable between operations (i.e. an SRO PCM cannot be used for Memory Mode and vice versa)

Both Memory Mode and SRO Mode PCM's have a single electrical 4mm banana Socket Connection at the top for bi-directional communication with the Surface Interface or with a shooting/logging CCL in Memory Mode. The lower part of the PCM has four electrical 4mm banana Socket Connections, as well as an orientation key for alignment into the Motor Module. It is important that the alignment key is oriented with the keyway in the Motor Module during engagement.

Figure 8 - Left image is top of PCM, Right image is Bottom of PCM

In the lower part of both PCM's on the outside diameter there are two holes of importance to the user, specifically when using the Memory Mode PCM. The larger hole allows access to the Micro USB-B programming port. The smaller hole allows visual access to the diagnostic LED.

When using the SRO Mode PCM the USB port is only used for uploading data and cannot be used for programming.

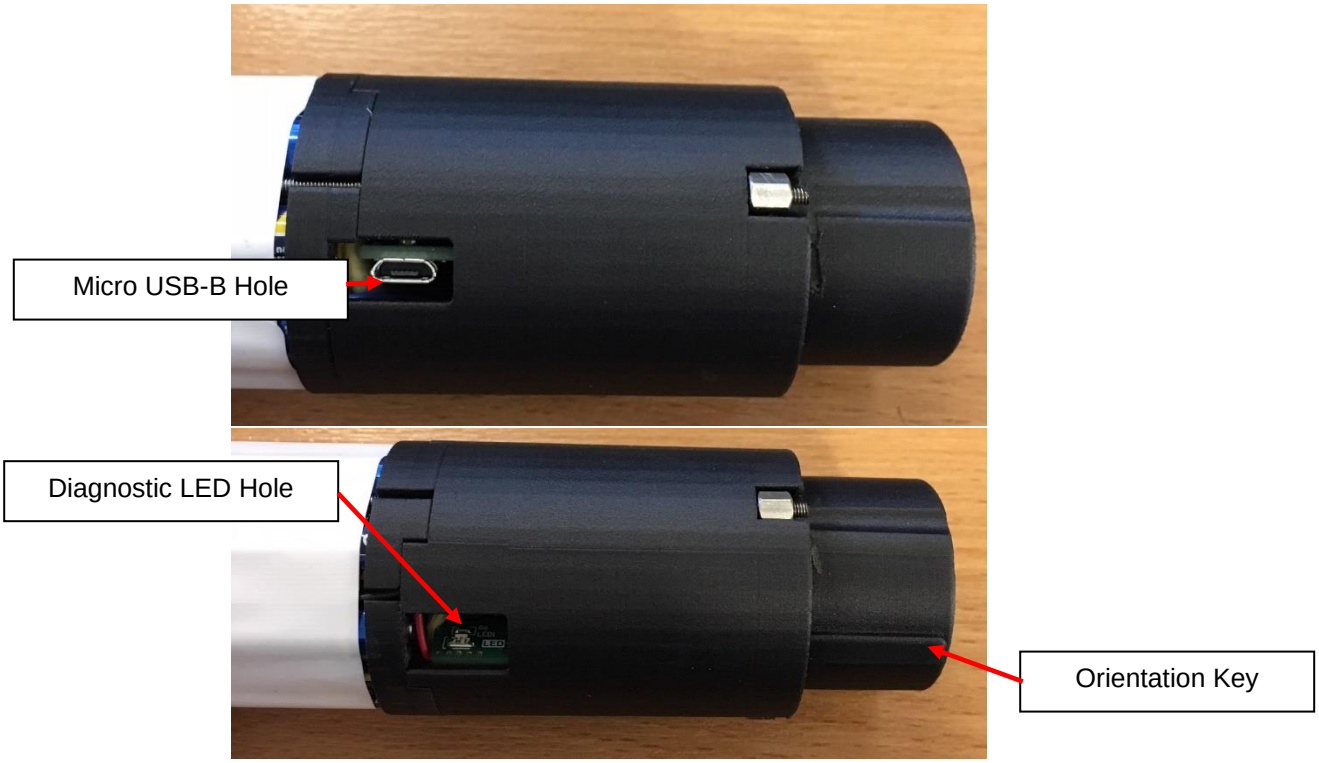


Figure 9 – PCM view showing USB port and LED position

When connected during programming or uploading via the micro USB-B port, power is supplied by the computer or Surface Interface and the green diagnostic LED will be ON. Once the LED is on continuously, the PCM is initialised and ready for programming/uploading via the **K-Log** software or programming via the Surface Interface.

The Diagnostic LED also provides a user confidence check when fitted to the **K-Set** for Memory Mode operation. When the Memory PCM has been programmed and fitted correctly to the **K-Set**, the diagnostic LED will begin flashing to indicate that the tool is in Countdown Timer mode. If, when fitted to the **K-Set**, the LED does not flash then the tool is not counting down and an error is present. The Memory PCM should be removed and re-programmed.

When the PCM is first connected to the **K-Set**, or during programming/uploading via the micro USB-B port, there is a time delay of approximately 5 seconds before the LED will activate, this is to allow the PCM to power up and initialize.

Table 6 - LED diagnostic indication legend

LED state	Meaning
Flashing Green (Memory Mode Only)	Tool functioning and in Countdown Timer Mode. Once the timer has elapsed then the tool will begin a Setting Cycle, Reset Command or Surface Test Command as programmed. ⚠ The LED will only flash for the first 10 minutes of the countdown before turning off to conserve power.
LED off when fitted to **K-Set** (Memory Mode Only)	Memory PCM is inert and not in use. **NO** Countdown Timer in process.
Permanently illuminated	USB power is detected and the PCM can be programmed/uploaded.

⚠ The alkaline cells used in the PCM have an inbuilt safety vent that will allow the electrolyte to be released in the event of a cell failure (i.e. if the cell is overloaded or overheated). This leakage can be harmful if it comes into contact with the user so all necessary PPE precautions should be utilised if this situation occurs; refer to the cell MSDS in Appendix B. Furthermore, large amounts of electrolyte leakage are also detrimental to the performance of the tool due to the corrosive properties of the electrolyte. Leaked electrolyte will be evident as a clear liquid which dries to form a white, salt like residue. If this electrolyte reaches the Motor Module then there is a risk that it may cause damage to the Motor windings and shorten its lifecycle. In the unlikely event of high-volume leakage of electrolyte from the cells then **kaseum** recommend that the Motor Module is replaced to ensure the performance of the **K-Set** is not compromised.

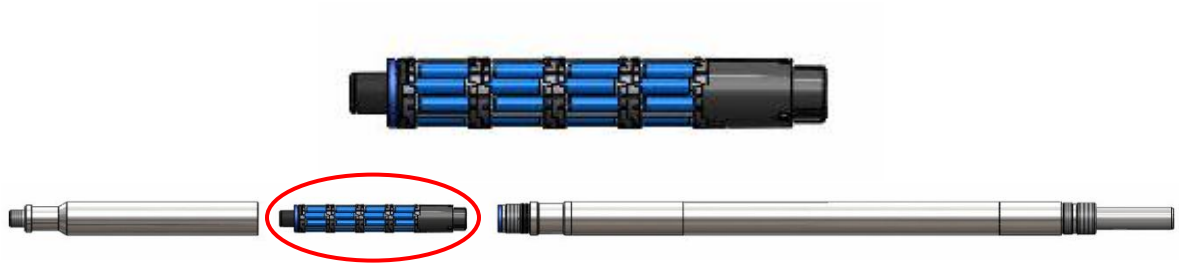


Figure 10 – PCM image and location

4.3 Motor Module

The Motor Module is easily identifiable as it has a reduced diameter section to allow for the fitment of a rig up spade during tool string make up in the well.

Figure 11 - Motor Module picture and location

The Motor Module is normally permanently made up to the Gearbox Module and Linear Actuator Module to form the **K-Set** main tool assembly. The Motor Module has the mating four 4mm electrical Banana Pin Connections for the PCM, along with the PCM alignment keyway at the top. During make up and removal of the PCM Housing the Motor Module should be held as a backup point. The Motor Module also contains the only elastomeric O-Rings that require field maintenance. The dual O-rings on the PCM/Motor Module connection should be changed:

- After each run in-hole.
- If any indication of damage is present.
- Or, as per company O-ring preventative maintenance procedure.

The Back-Up rings should be suitable for use until the first major service interval. However, if any damage is noted during operational use then these should be changed.

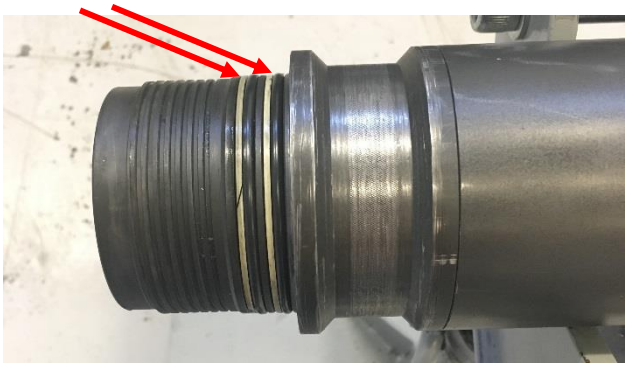


Figure 12 - Picture showing Motor Module field replaceable O-rings

4.4 Linear Actuator Housing

The Linear Actuator Module is normally permanently fitted to the Motor Module and Gearbox Module. There is no maintenance for the field user, however it is important to identify this assembly, specifically the Linear Actuator Housing, as it is backup point when making up Inner Running Adaptors to the Slick Rod. The Slick Rod is rotationally locked through this Linear Actuator Housing so this Housing is the most suitable backup point.

When making up Adaptors to the Slick Rod it is **IMPERATIVE** that the Slick Rod is not held/gripped as a backup point. The Slick Rod is a dynamic sealing surface and any damage to this part **WILL** cause improper function of the tool.

Figure 13 – Linear Actuator Housing location

4.5 Outer Adaptor

The Outer Adaptor is the lowest pressure Housing on the **K-Set** and is part of the Linear Actuator Module. The Outer Adaptor has a 2" Stub Acme thread for make up to Setting Sleeve Running Adaptors. This Housing is the backup point for making up and breaking out of Setting Sleeve Running Adaptors.

When making up Setting Sleeve Running Adaptors with retaining Set Screws it is important that these Screws are removed sufficiently before any rotational movement is applied to ensure that the Outer Adaptor thread is not damaged. If any damage is present then it should be dressed off with suitable tooling immediately to eliminate the risk of thread galling.

The Outer Adaptor houses the sealing arrangement for the Slick Rod, which comprises of a single Wedge Seal and Back-Ups, along with a PTFE Rod Seal and Back-Up. These seals require periodic servicing which is outlined in section *15 Periodic and Routine Service Instructions* of the manual.

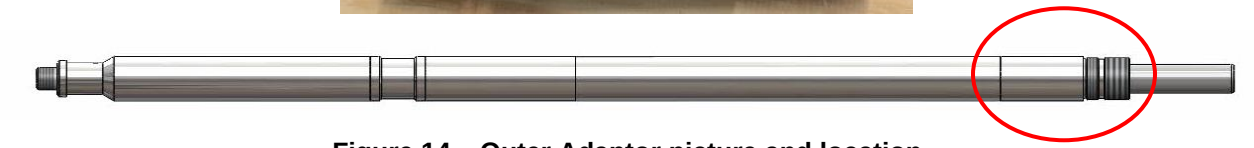


Figure 14 – Outer Adaptor picture and location

4.6 Slick Rod

The Slick Rod is the only external moving part of the tool and moves into the Outer Housing by 10” (Standard Length) or 16” (Extended Length) from its normal start, or *Ready to Run* position. The Slick Rod is easily identifiable as it is the lowest part of the **K-Set** and has a distinctive chrome coating as it acts as the dynamic sealing surface. With this in mind it is **IMPERATIVE** that this part is not handled with any tooling at all during the life of the **K-Set**. The Slick Rod has a 11/16” UN thread for make up to Inner Running Adaptors for the wellbore device. When the tool is ready for deployment the Slick Rod should protrude by 127mm from the Outer Adaptor end face, this indicates the correct *Ready to Run* position.

Figure 15 - *Ready to Run* position

The Slick Rod is conditioned by a hardening process during manufacture and so any damage to this thread will be difficult to repair, consequently, all measures to protect this thread should be taken.

When making up Inner Adaptors to the Slick Rod it is **IMPERATIVE** that the Slick Rod is not held/gripped as a backup point. The Slick Rod is a dynamic sealing surface and any damage to this part **WILL** cause well fluids to enter the tool leading to tool failure.

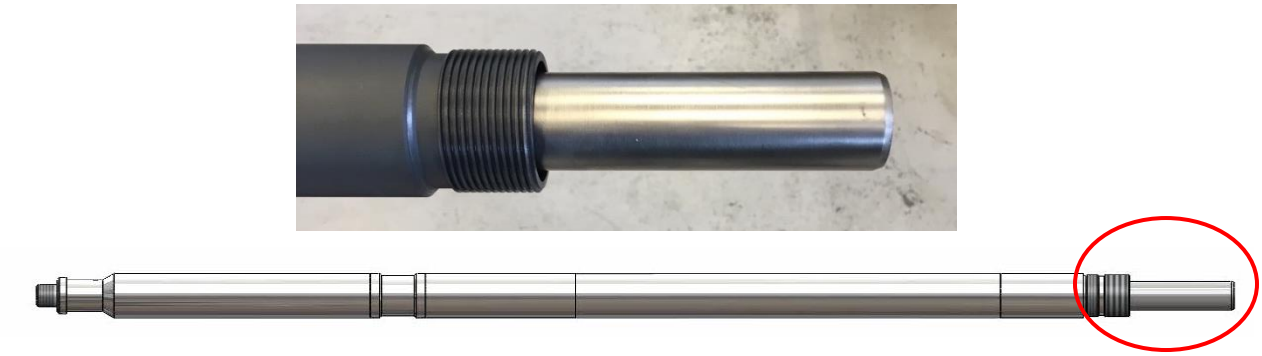


Figure 16 - Picture of Slick Rod and location

Due to the design of **K-Set** there is a piston effect (approximately 1.49in^2) that acts on the Slick Rod when exposed to external pressures. External pressure **positively** aids the **K-Set** during the Setting Cycle (i.e. the higher the external pressure on the **K-Set**, the less load that needs to be generated by the tool to achieve the setting and disconnect loads required for the wellbore device).

The hydrostatic effect on the **K-Set** is controlled by means of a mechanical and electrical brake mechanism during normal operation, which stop the Slick Rod being forced upward (‘Backwinding’) when the tool is not running.

5 Installing the K-Log Software Application

K-Log is the main software application for programming the PCM.

5.1 Pre-operational requirements

5.1.1 USB Interface Cable Driver Installation

A USB interface cable is used to connect the PCM to the **K-Log** software. The USB Interface Cable (**kaseum** part number 001223) utilizes the FTDI drivers, and the associated drivers need to be installed for successful programming to be achieved. The drivers will automatically install when the USB Interface Cable is first installed into a computer with internet access, and will assign the cable a numeric serial port (or com port) number. If the drivers do not install successfully then they can be manually installed by running the following executable file which can be found on the FTDI website at the following location.

http://www.ftdichip.com/Drivers/VCP.htm

A copy of these drivers will be available on the USB flash drive provided with the **K-Set** on initial delivery.

5.1.2 K-Log Software Installation

K-Log is the name of the software application that, once installed, will allow the user to program the PCM. This software installation file is available on the USB data stick supplied with each tool on delivery, or can be obtained by emailing info@kaseum.com. To install:

- Launch the tool application installation executable, named 'K_Log_Setup.X.X.XXXX.XXXXX' (where X.X.XXXX.XXXX is the latest software version) and follow the installation wizard to install the application.

Figure 17 - Image of the setup application file

- The application will automatically create folders with all required associated files in the following locations:

C:\Users\Public\Documents\K-Log

C:\Users\Program Files (x86)\Kaseum Technology Ltd

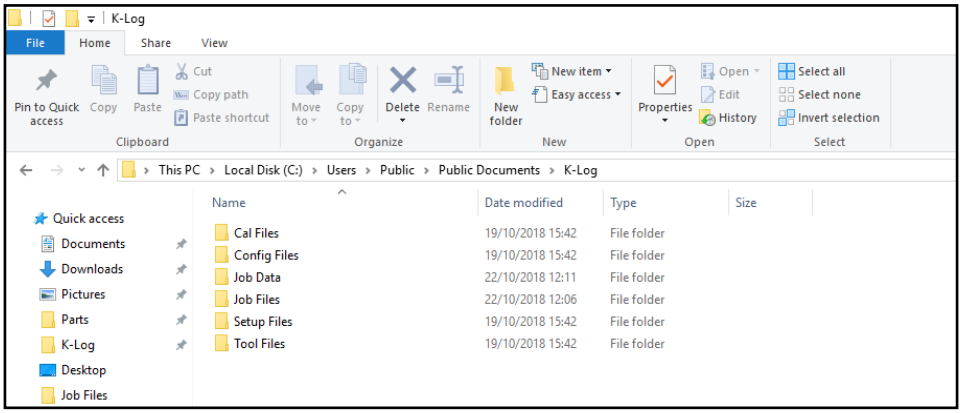


Figure 18 - Image of file and folders installed during initial software installation

The files and folders created during the installation of the software **should not** be amended in any way. Changes to these files or folders will cause errors and will not allow the **K-Set** to be programmed. If any changes are required please contact info@kaseum.com

- Once installed, the application can be launched by double clicking the desktop app icon, or through the Windows start menu.

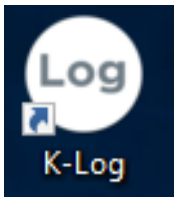


Figure 19 – K-Log desktop icon image

- The **K-Log** home screen will be populated:

Figure 20 – K-Log Home screen

5.2 K-Log screen navigation

The following functionality is available through the **K-Log** screen:

5.2.1 Title bar commands.

- **Home command**. The Home command icon will take the user directly back to the **K-Log** home screen when selected in any **K-Log** programming screen.

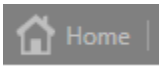


Figure 21 – Home command icon

- **Settings command**. The Settings command icon will direct the software to the advanced permission user password screen. Advanced permissions are for **kaseum** use only. In the Settings screen the user can also manually select the com port if desired. all connected serial ports will be populated in the serial port drop down tree. Choose the drop-down icon and select the correct comport in use, or leave the 'Scan All Ports' option and the software will automatically scan for the connected PCM.

Figure 22 – Settings command icon

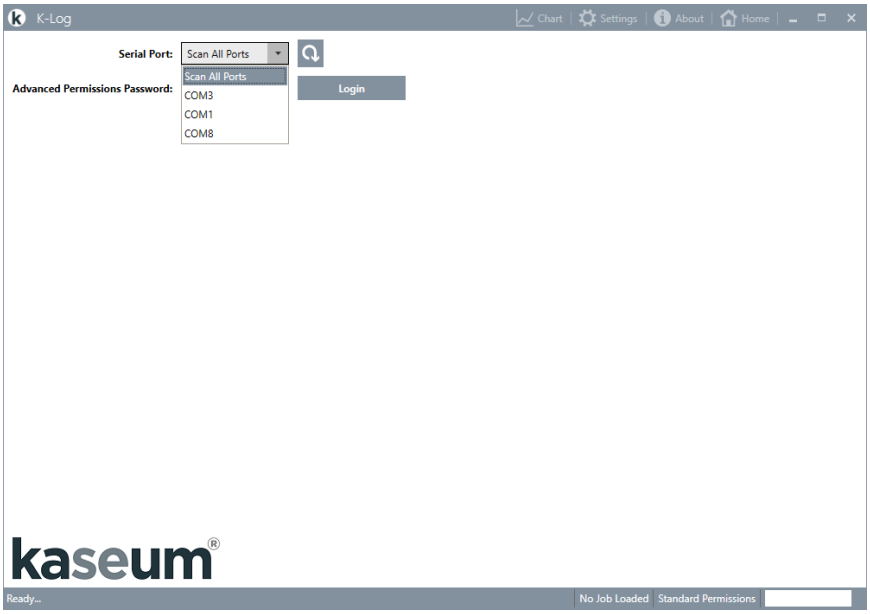


Figure 23 – Serial port drop down tree view in Settings screen

- **Chart command**. The Chart command icon will direct the software to a visual charting package screen. In this screen uploaded PCM run data can be loaded and viewed in a graphical format for easy interpretation.

Figure 24 – Chart command icon

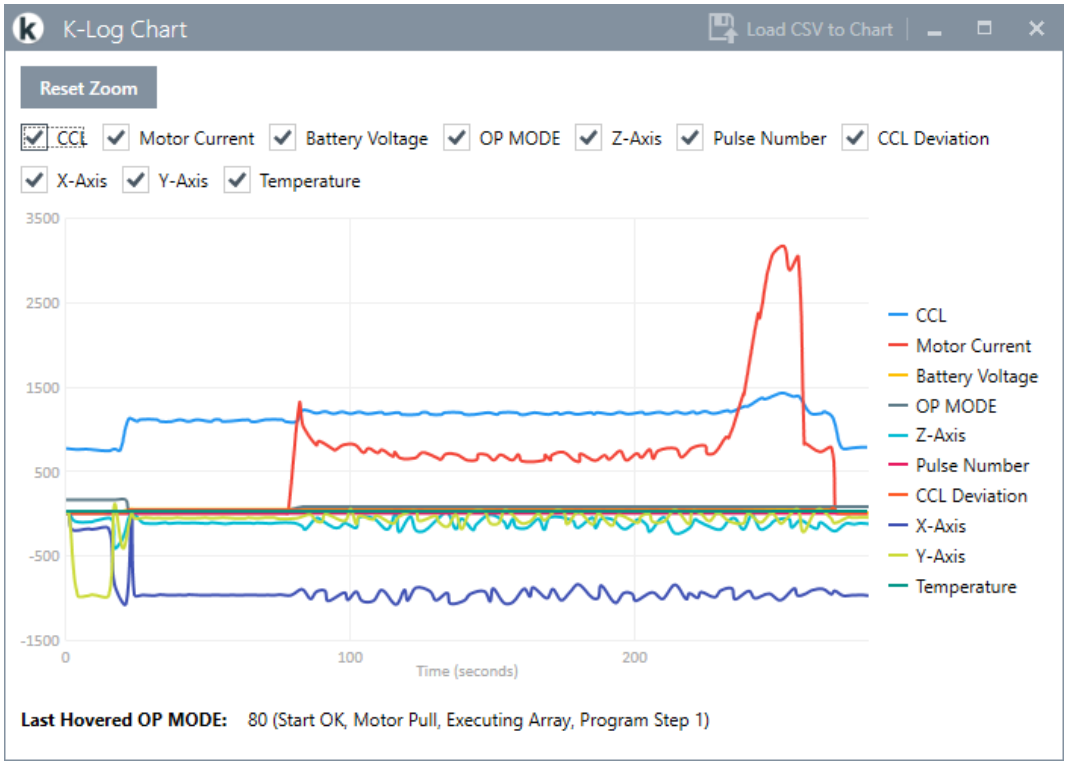


Figure 25 – Example of a K-Set run chart

In the Chart screen the measured channels can be turned on or off as required. Also, the operational mode (or OP mode) of the tool will be populated, along with a description of the PCM status during the operation.

- **About command**. When selected an information box will be populated showing the software revision level.

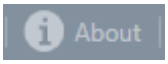


Figure 26 – About command icon

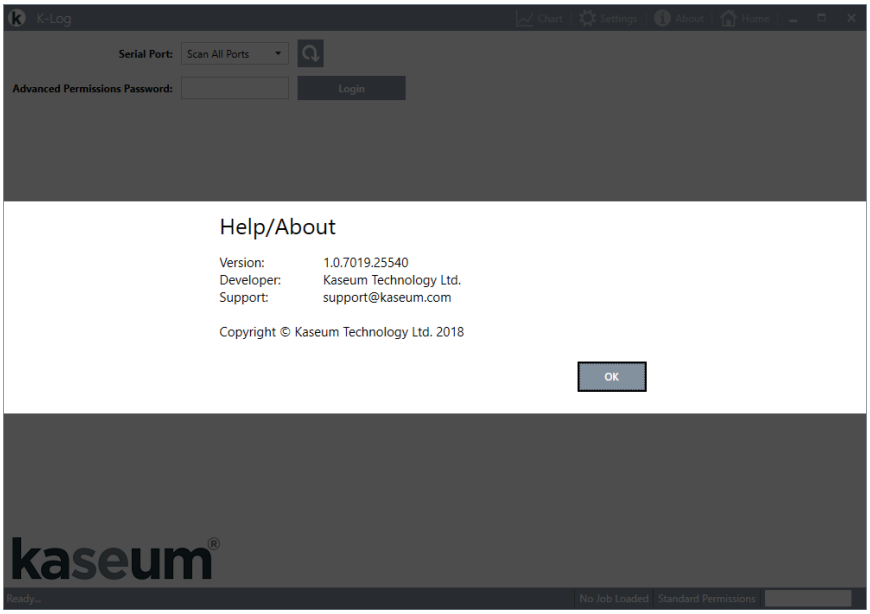


Figure 27 – About screen

5.2.2 Message bar options

- **Status message.** The lower left part of the **K-Log** screen is the status message box for user feedback. Several messages to indicate the software status and specific error messages are populated here.

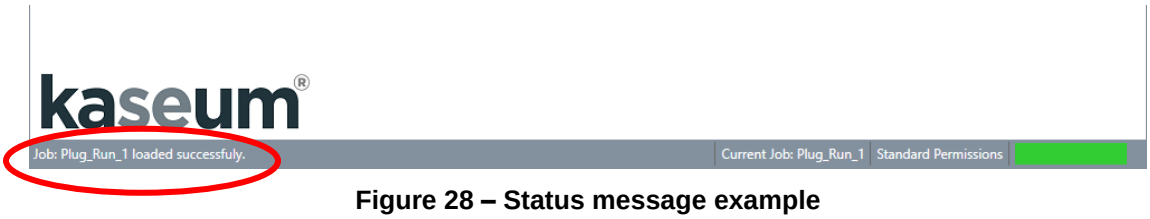


Figure 28 – Status message example

- **Current Job message**. The current Job folder is also populated in the centre of the lower message bar. This message box can be used as a hyperlink and when clicked it will automatically open a Windows explorer screen to the current job folder.

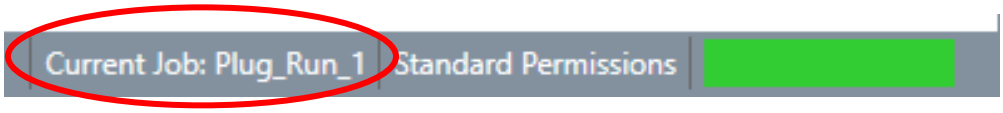


Figure 29 – Current job message example

- **Permission level.** The current software permission level will also be populated in the lower right-hand corner of the message bar. This should always be defaulted to the 'Standard Permission' level.

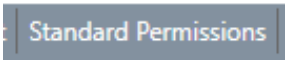


Figure 30 – Permission level example

6 Operating the K-Set in 'Memory Mode'

6.1 K-Set theory of 'Memory Mode' operation

Once at the jobsite the **K-Set** can be readied for deployment. The user must take a new, unused memory PCM and program it with the required Countdown Timer. The Countdown Timer is the amount of time required from the point at which the user connects the PCM to the **K-Set** main assembly until the time at which the **K-Set** begins the setting cycle. Once this Countdown Timer is programmed the PCM is ready.

When the **K-Set** is to be deployed in hole the user must remove the PCM Housing from the Motor Module. The PCM is then orientated and connected to the Motor Module and the Countdown Timer will begin as soon as the LED confidence check is observed (the Countdown Timer begins typically 5 seconds after connection to allow the PCM to initialise). The PCM Housing is then fitted and tightened to the Motor Module. The **K-Set** is now fully assembled and can be deployed to the required setting depth and held stationary prior to the Countdown Timer expiring.

Once the Countdown Timer expires the **K-Set** will begin stroking and the wellbore device will begin setting into the wellbore. The **K-Set** will take approximately 17 minutes (Standard Length) or 26 minutes (Extended Length) to fully stroke. During this time the user should check for any and all indications that the wellbore device has set and disconnected from the **K-Set** (tool string weight fluctuation, pressure differences, movement on the conveyance wire etc.) and the **K-Set** should remain stationary during this setting process. Once the run time has expired and a good indication of the wellbore device being disengaged from the conveyance method is observed, then the **K-Set** can be recovered to surface.

6.2 PCM User Interface

The PCM is the main electronic controller of the **K-Set**. The user has the ability to program and perform four operational functions, which are:

- **Program/Perform Pull**. The 'Program/Perform Pull' function allows the user to initiate a Pull/Set command to the **K-Set**. This can be sent instantaneously (if in SRO Mode) or after a user set Countdown Timer Delay (if in Memory Mode).
- **Retrieve Data**. The saved run data on any PCM can be retrieved using this function.

The saved PCM data can only be retrieved using the **K-Set** software and cannot be retrieved by the Surface Interface Box.

- **Reset Tool**. After deployment in hole the **K-Set** can be 'Reset' back to the *Ready to Run* position by programming a 'Reset' command. This is explained in more detail in section *9 How to Reset the **K-Set*** of this manual.
- **Surface Test**. Prior to deployment the **K-Set** can be tested for functionality by means of a 'Surface Test'. This is explained in more detail in section *8 How to Surface Test the **K-Set*** of this manual.

6.3 How to Program/Perform Pull in 'Memory Mode'

The operational parameters of the setting cycle (e.g. maximum current limit, maximum run time etc.) are pre-set as default values in the PCM, and these do not need to be altered for normal operational use. Any amendment of these parameters must be done so by experienced personal or under the instruction of **kaseum**. The user is only required to program the Countdown Timer before each operation.

The Memory PCM can be programmed using either of the following methods:

- By using the **K-Log** programming software application (**kaseum** part number 001229)
- By using the **K-Set** Surface Interface Box Assembly (**kaseum** part number 000952) herby referred to as 'Surface Interface"

6.4 How to Program/Perform Pull in 'Memory Mode' using K-Log

When using the **K-Set** in Memory Mode, a Countdown Timer has to be user set and programmed to a Memory PCM. The Countdown Timer delay is the amount of time that will elapse from the point at which the PCM is connected to the **K-Set** main tool assembly until the **K-Set** begins the setting operation. To program a Countdown Timer:

- Orient and connect the USB Interface Cable into the Comms port of the PCM and wait for the diagnostic LED to be constantly illuminated. Launch the **K-Log** software if not already open.

Figure 31 – Photo of PCM connected and LED diagnostic indicator

- The **K-Log** Home screen will be populated.

Figure 32 - K-Log Home screen

- The ‘Job’ command is the first command icon that must be selected by the user.

Figure 33 – Job command icon

- Before any programming can commence a Job folder must be created as a location to store all relevant programming files and tool data. Select the ‘Job’ command icon and either create a new job folder, or navigate to find a previously created folder. All job folders are saved in the following default location:

C:\Users\Public\Documents\K-Log\Job Files

Figure 34 – Job command screen

- Once a Job has been selected/created, the ‘Connect’ command icon will appear. This command will allow the software to interrogate all connected com ports to establish communication with the PCM.

Figure 35 – Connect command icon

- Select the ‘Connect’ command icon. Once connected the Main **K-**Log Screen will be opened. The message status bar will give an indication if the PCM has connected, along with the PCM part number.

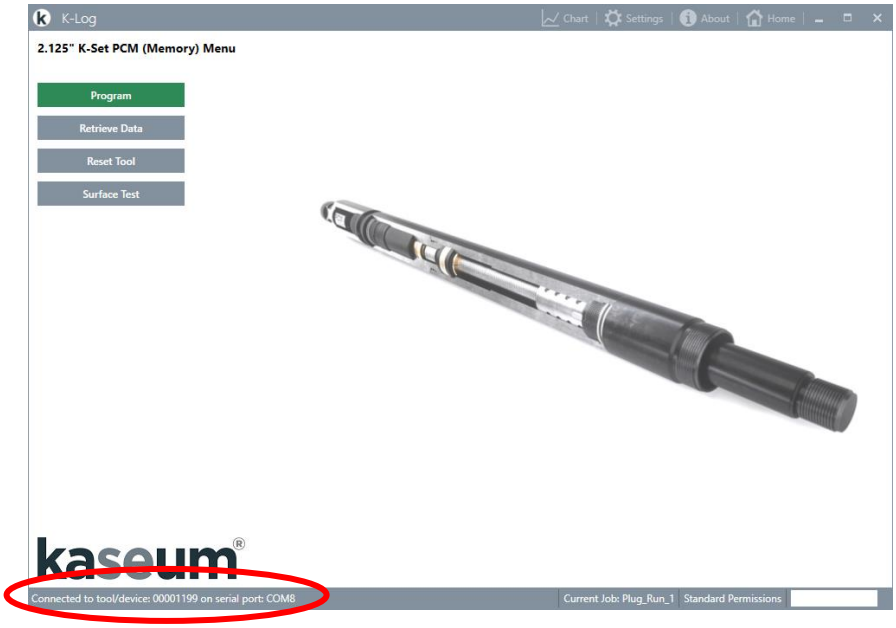


Figure 36 - Main K-Log screen and connection status message identification

As mentioned previously, the Countdown Timer is the amount of time the **K-Set** will wait after the PCM is connected to the main **K-Set** tool body assembly before initiating the setting cycle or pull command. To program a Countdown Timer:

- Select the 'Program' command icon.

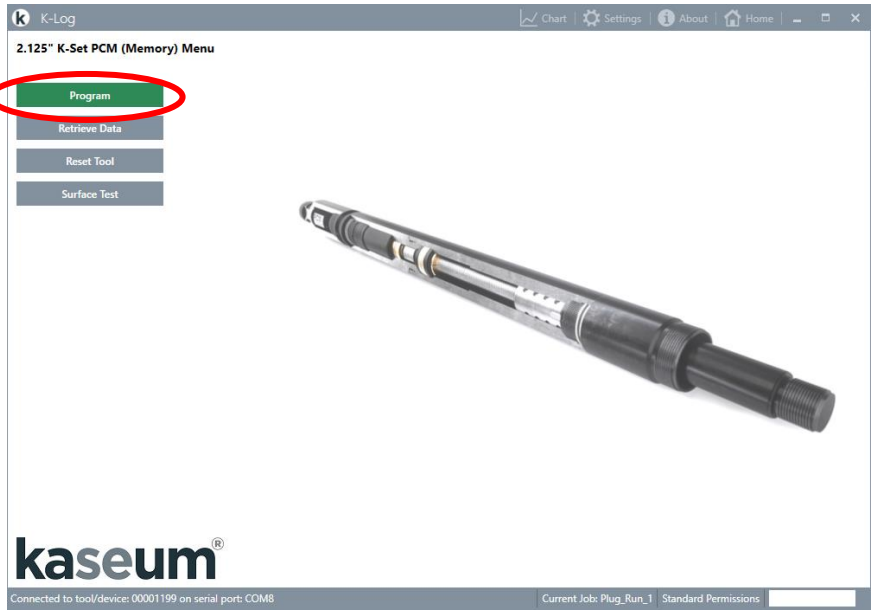


Figure 37 - Program command icon

- Enter the Countdown Timer required **in minutes** into the 'Set Countdown Timer' Box. Note: the software will only accept a numerical value in minutes. Once the Countdown Timer value has been correctly entered, click on the 'Program Tool' command icon and programming will commence.

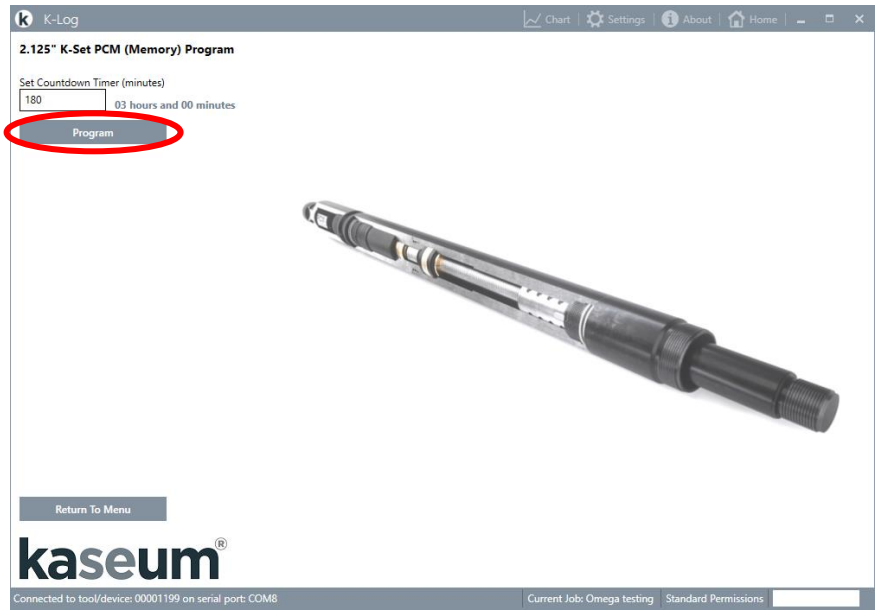
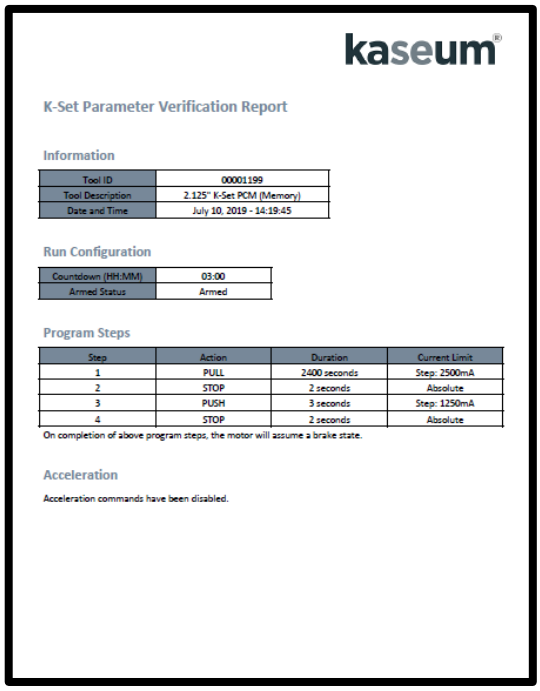


Figure 38 – Program tool screen

- Once complete, a successful completion status message will be populated in the lower command bar.

Figure 39 – Programming success message image

- A pdf. verification report will also be populated and saved to the job folder, which outlines all the programmed parameters of the PCM.



kaseum®

K-Set Parameter Verification Report

Information

Tool ID	00001199
Tool Description	2.125" K-Set PCM (Memory)
Date and Time	July 10, 2019 - 14:19:45

Run Configuration

Countdown (HH:MM)	03:00
Armed Status	Armed

Program Steps

Step	Action	Duration	Current Limit
1	PULL	2400 seconds	Step: 2500mA
2	STOP	2 seconds	Absolute
3	PUSH	3 seconds	Step: 1250mA
4	STOP	2 seconds	Absolute

On completion of above program steps, the motor will assume a brake state.

Acceleration

Acceleration commands have been disabled.

Figure 40 – Example Verification report

The PCM **should not be used** if any error message is populated in the verification report.

The verification report will provide the user with the following information:

- Tool ID number and description.
- Date and Time of programming.
- Countdown Timer programmed and arming status of the tool.
- Program Steps. The program steps are the actions the **K-Set** is programmed to perform. As a default, a setting cycle program step should be actioned to **PULL** for **2400 seconds (40 minutes)** with a **2500mA** current limit specified.

If no Program Step Current Limit is defined then the PCM will use the default Absolute Current Limit Value.

Program Steps

Step	Action	Duration	Current Limit
1	PULL	2400 seconds	Step: 2500mA
2	STOP	2 seconds	Absolute
3	PUSH	3 seconds	Step: 1250mA
4	STOP	2 seconds	Absolute

On completion of above program steps, the motor will assume a brake state.

Figure 41 – Example program step array

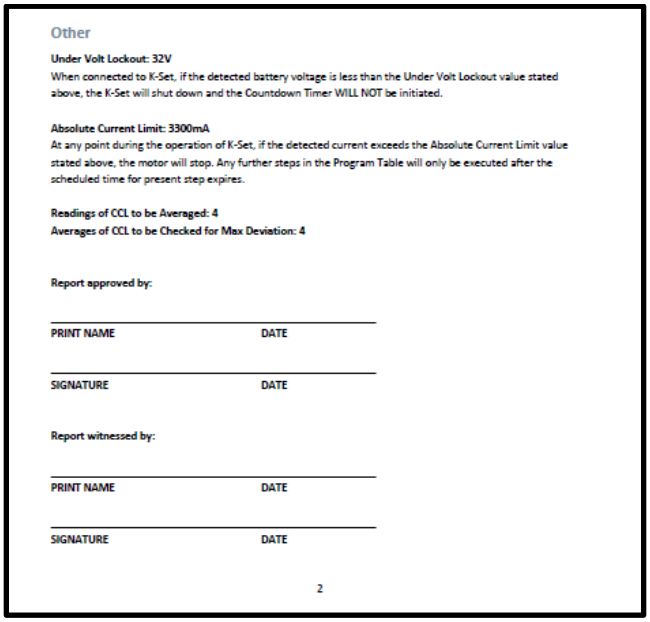
- Acceleration commands (if enabled). The report will show the acceleration activation commands available, along with the sequence required to initiate them. This is currently defaulted to **OFF as acceleration commands will be introduced in later firmware revisions of the PCM.**
- Logging configuration. This is a list of the logged channels and the rate at which these channels log data to memory.

Logging Configuration

Channel	Logging Rate (K-Set Off)	Logging Rate (K-Set On)
CCL	10 times per second	20 times per second
Motor Current	10 times per second	20 times per second
Battery Voltage	10 times per second	20 times per second
OP MODE	10 times per second	20 times per second
Z-Axis	10 times per second	20 times per second
Pulse Number	10 times per second	20 times per second
CCL Deviation	10 times per second	20 times per second
X-Axis	10 times per second	20 times per second
Y-Axis	10 times per second	20 times per second
Temperature	10 times per second	20 times per second

Figure 42 – Example logging configuration verification

- Voltage lockout value. This is the lower threshold voltage of the Memory PCM. If, when the PCM is connected to the **K-Set**, the voltage detected is less than this value then the PCM will be 'locked-out' and an LED confidence check will not occur indicating an error status. This value is defaulted to **32 Volts**.
- Absolute Current Limit. This current value is used as a protection method to ensure that the tool is not operated out with its safe operational window. If at any point during the operation of the tool this current value is exceeded then the tool will shut down. This value is defaulted to **3300 mA**.
- CCL averaging values.
- Sign off section.



Other

Under Volt Lockout: 32V
When connected to K-Set, if the detected battery voltage is less than the Under Volt Lockout value stated above, the K-Set will shut down and the Countdown Timer WILL NOT be initiated.

Absolute Current Limit: 3300mA
At any point during the operation of K-Set, if the detected current exceeds the Absolute Current Limit value stated above, the motor will stop. Any further steps in the Program Table will only be executed after the scheduled time for present step expires.

Readings of CCL to be Averaged: 4
Averages of CCL to be Checked for Max Deviation: 4

Report approved by:

PRINT NAME DATE

SIGNATURE DATE

Report witnessed by:

PRINT NAME DATE

SIGNATURE DATE

2

Figure 43 – Example of 'Other' logging configuration section

6.5 Retrieving data from a PCM

When any (i.e. SRO Mode or Memory Mode) PCM is connect to a **K-Set** main tool assembly it will begin recording data to the onboard PCM flash memory. This data can be retrieved for analysis and interpretation by the user. To retrieve the data:

- Connect the USB Interface cable into the Comms port of the PCM module and launch the **K-Log** software if not already open.
- Create a new job folder, or load a previous job folder, using the 'Job' command icon.
- Select the 'Connect' command icon to open the Main **K-Log** screen.
- Select the 'Retrieve Data' command icon.

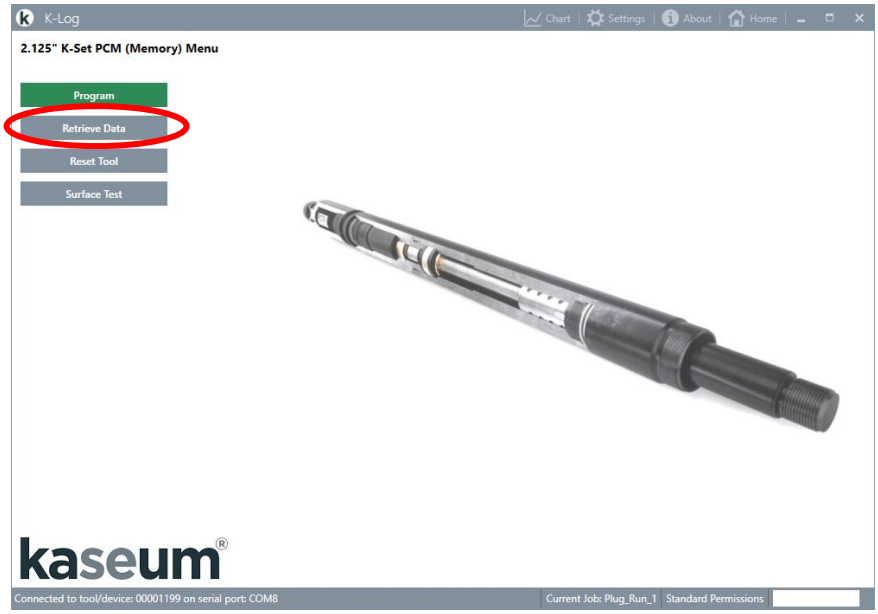


Figure 44 Retrieve data command icon

- The following warning will be populated. Once observed select the 'Retrieve Data' command icon and the data will be uploaded from the PCM to the Job Folder.

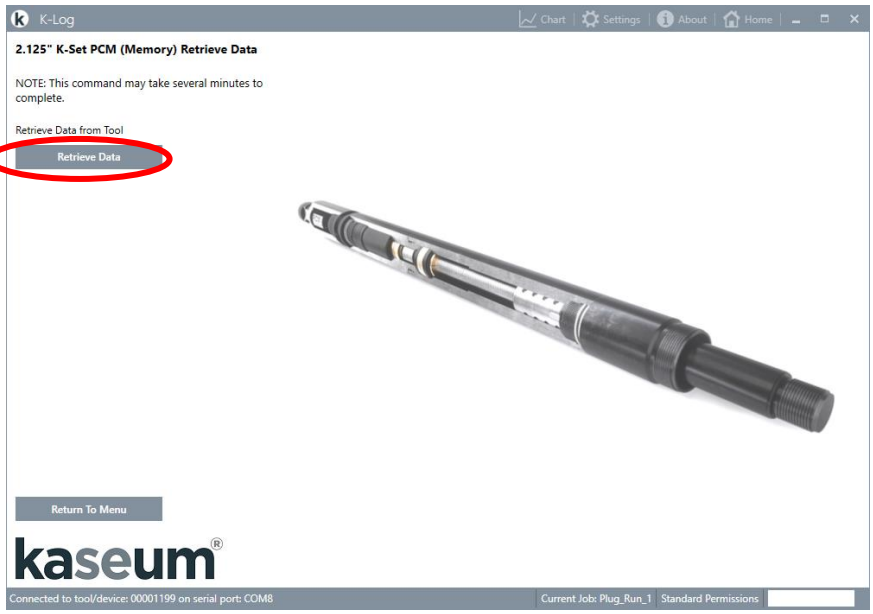


Figure 45 - Retrieve data warning screen

- When the data is successfully retrieved a 'successful' status message will be populated in the message bar with the associated file name. this file will be saved in the current Job folder.

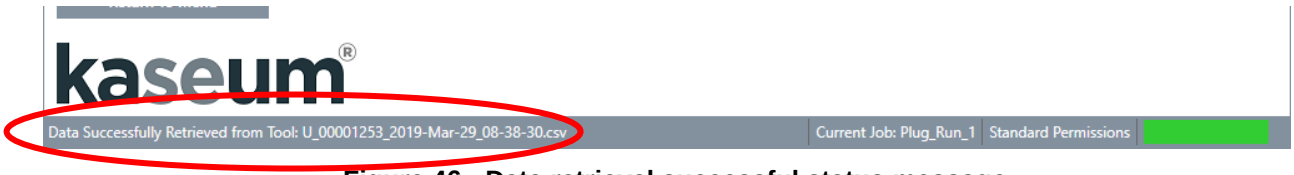


Figure 46 - Data retrieval successful status message

6.6 Programming a Reset command using K-Log software

Once the **K-Set** has completed a setting cycle it must be 'Reset' in order to perform the next operation. The **K-Set** is automatically 'Reset' by programming a PCM with the Reset command which will automatically drive the Slick Rod back to the *Ready to Run* position. The Reset procedure is explained in more detail in section *9 How to Reset the **K-Set*** of this manual. Programming a Reset command is very similar to the above procedures of programming a Countdown Timer and 'Surface Test' command:

- Connect the USB Interface Cable into the Comms port of the Memory PCM and launch the **K-Log** software if not already open.
- Create a new job folder, or load a previous job folder, using the 'Job' command.
- Select the 'Connect' command icon to open the Main **K-Log** screen.
- Select the 'Reset Tool' command icon.

Figure 47 – Main K-Log screen and Reset Tool command icon

- The following warning screen will be populated explain the function of the ‘Reset Tool’ command. Once the warning has been observed select the ‘Reset Tool’ command icon.

Figure 48 - Reset Tool warning screen

- The software will then program the Memory PCM with the correct parameters in which to perform a ‘Reset’ command when connected to the **K-Set**. Once the programming is complete a ‘Successful’ message will appear in the bottom status box and .pdf Verification Report will be populated. The PCM is now ready to perform a ‘Reset’.

Figure 49 - Example of successful surface test programmed message

- The.pdf Verification Report for the ‘Reset Tool’ command will report the following program steps:

Program Steps

Step	Action	Duration	Current Limit
1	PUSH	2400 seconds	Step: 1250mA
2	STOP	2 seconds	Absolute
3	PULL	3 seconds	Step: 1250mA
4	STOP	2 seconds	Absolute

On completion of above program steps, the motor will assume a brake state.

Figure 50 - Example 'Reset' program steps

6.7 Programming a Surface Test using K-Log software

In order to check the operational performance of the **K-Set**, a ‘Surface Test’ can be performed, whereby the **K-Set** will pull against a test fixture, generating a load and an indication of the amount of load that has been generated. The Surface Test procedure is outlined in section *8 How to Surface Test the **K-Set*** of this manual. Programming a ‘Surface Test’ is very similar to the above procedure of programming a Countdown Timer:

- Connect the USB Interface cable into the Comms port of the PCM module and launch the **K-Log** software if not already open.
- Create a new job folder, or load a previous job folder, using the ‘Job’ command icon.
- Select the ‘Connect’ command icon to open the Main **K-Log** screen.
- Select the ‘Surface Test’ command icon.

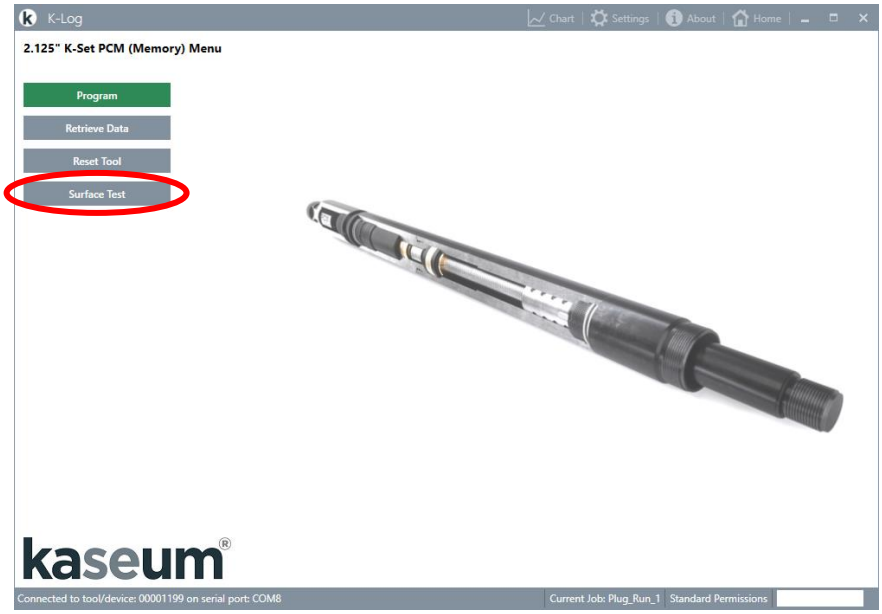


Figure 51 – Main K-Log screen and Surface Test command icon

- The following warning screen will be populated explaining the function of the 'Surface Test'. Once the warning has been observed select the 'Surface Test' command icon.

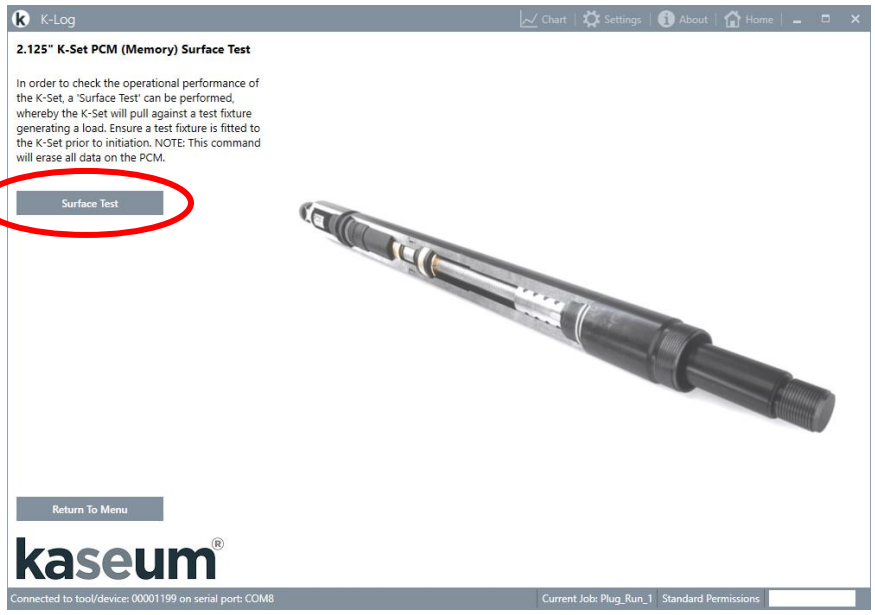


Figure 52 - Surface Test Warning message

- The software will then program the Memory PCM with the correct parameters in which to perform a 'Surface Test'. Once the programming is complete a 'Successful' status message will appear in the bottom message bar and .pdf Verification Report will be populated. The PCM is now ready to perform the 'Surface Test'.

Figure 53 - Example of successful 'Surface Test' programmed message

- The.pdf verification report for the 'Surface Test' will report the following program steps:

Program Steps

Step	Action	Duration	Current Limit
1	PULL	180 seconds	Step: 1250mA
2	BRAKE	10 seconds	Absolute
3	PUSH	240 seconds	Step: 1250mA
4	STOP	2 seconds	Absolute
5	PULL	3 seconds	Step: 1250mA
6	STOP	2 seconds	Absolute

On completion of above program steps, the motor will assume a brake state.

Figure 54 - Example 'Surface Test' program steps

6.8 Programming the Memory PCM with the Surface Interface.

The Surface Interface (**kaseum** part number 00952) is primarily used for viewing live data and commanding the **K-Set** in real time during SRO Mode, but it can also be used to program the default Memory Mode PCM parameters for a Memory operation if **K-Log** is not available.

6.8.1 Surface Interface physical interface connections

The main display on the Surface Interface is a capacitive touch screen which is used to navigate and function the Surface Interface software. The Surface Interface also has multiple physical connections that can be utilized by the user during both Memory Mode programming and SRO Mode use. When the Surface Interface is opened the user will see the main capacitive touch screen display in the centre with several physical connections on the panel. The function of these connections is described below:

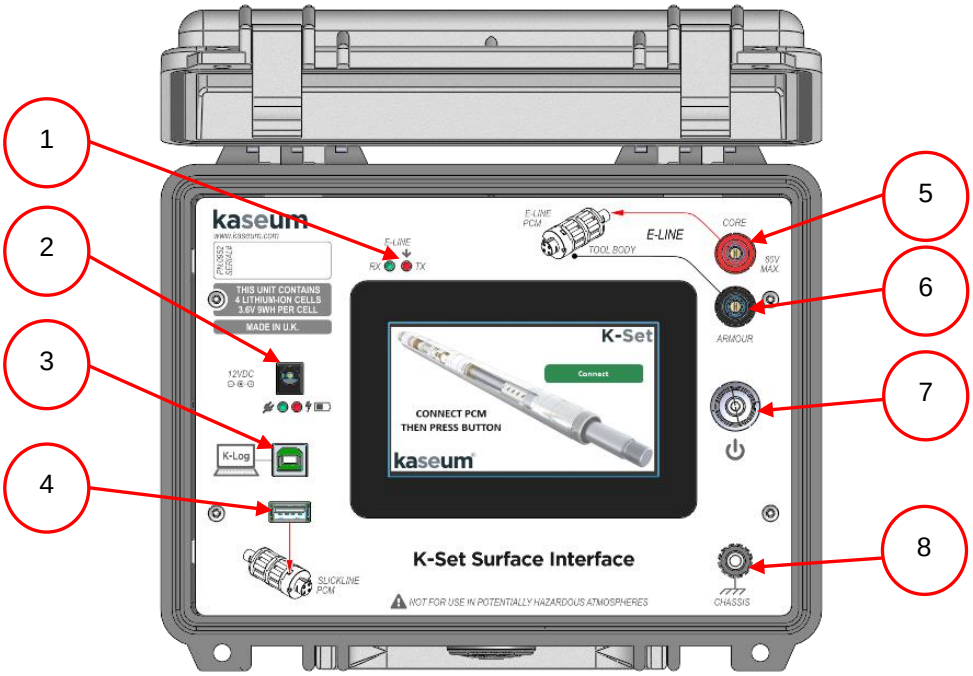


Figure 55 - Image of Surface Interface

Table 7 - Surface Interface physical connection legend

Item Number	Description	Use
1	Receive (Rx) and Transmit (Tx) LED indicators	When in SRO Mode the Receive and Transmit LED's are used as a diagnostic indication of whether the SRO communications are being sent or received.
2	12 Vdc Charging Point	This connection is used for charging the internal battery of the Surface Interface.
3	**K-Log** Data Viewing Port (USB type B)	When in SRO Mode a computer can be connected to stream the real time data for real-time graphical viewing on the **K-Log** software package.
4	Memory Mode Programming Port (USB type A)	This port allows a Memory PCM to be connected to the Surface Interface for programming.
5	E-Line Conductor (4mm Banana socket connection)	Allows connection to the wireline Conductor for use during SRO communications to the SRO PCM in real time.
6	E-Line Armour (4mm Banana socket connection)	Allows return connection to the wireline Armour for use during SRO communications to the SRO PCM in real time.
7	Power button	Turns the power to the Surface Interface ON or OFF.
8	Chassis/Ground (4mm Banana socket connection)	Allows additional safety grounding point for the Surface Interface.

6.8.2 Pre-programing requirements

- Turn on the power to the Surface Interface by pressing the Power button. The Home screen with be populated after a short delay and an internal battery level indicator will appear at the top right of the Display. If the battery requires charging then connect the 12 Vdc Adaptor Cable to the charging point.

Figure 56 - Image showing Internal Battery level indicator

- For diagnostic purposes the software and firmware visions of the Surface Interface can be checked by selecting the 'Version' icon at the top of the Screen.

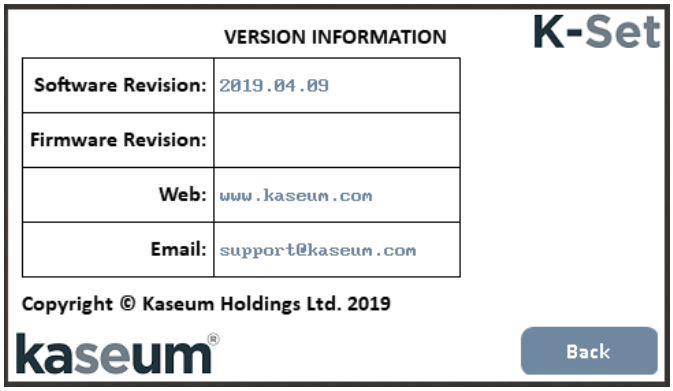


Figure 57 - Version information Screen

- Connect the Memory PCM to the Memory Mode Programming Port using the USB Interface Cable (**kaseum** part number 001223). Wait for the diagnostic LED on the PCM to be constantly illuminated.

Figure 58 - USB connected to PCM and diagnostic LED illuminated

- Select the 'Connect' icon on the Home screen.

Figure 59 – Surface Interface Home Screen

- Once a Memory PCM has been detected the display will populate a warning indicating that the Surface Interface is configured to be used with a specific size of **K-Set** only. **ENSURE** that the size mentioned in the warning screen is the same **K-Set** OD size that is to be used.

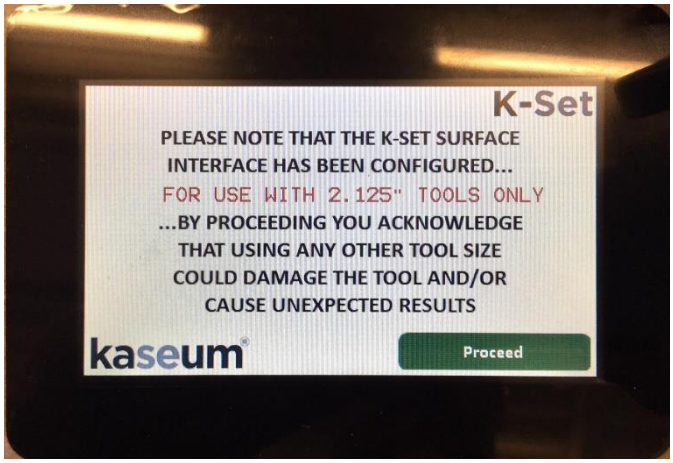


Figure 60 – 2.125" OD Surface Interface warning message

USER CAUTION. DO NOT program a Memory PCM using a Surface Interface that is not configured for the correct size of **K-Set**. Failure to follow this warning **WILL** cause tool and operational errors which may result in a partial set plug downhole.

- Once the connection has been established the Slickline Mode screen will be displayed. There are three operational functions on the Slickline Mode screen, they are:
  - Program Tool.
  - Reset Tool.
  - Surface Test.

6.9 Programming a Countdown Timer Delay using the Surface Interface 'Program Tool' command

When this 'Program Tool' icon is selected the Memory PCM can be programmed.

- Select the 'Program Tool' icon.

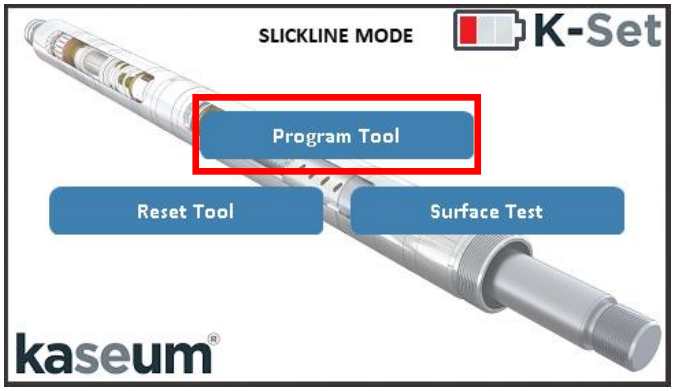


Figure 61 **- Slickline Mode screen**

- A warning screen will be generated asking if this command is to be carried out. Selecting 'Yes' will begin the programming function. Selecting 'No' will return the user back to the Slickline Mode screen.

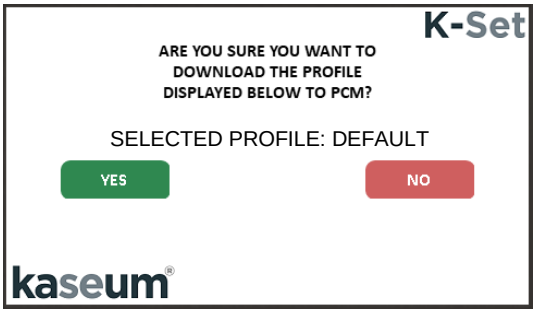


Figure 62 - Warning screen

- If 'Yes' is selected the default parameters will be programmed to the Memory PCM. This process will take approximately 90 seconds.
- The Countdown Timer screen will then be displayed. Using the Plus (+) and Minus (-) icons the user can input the required Countdown Timer in hours and minutes. Once the delay is correct select the 'Apply Countdown' icon.

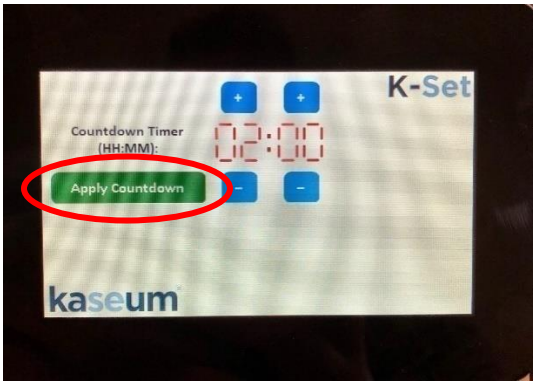


Figure 63 - Countdown Timer screen

- Once completed a 'Successfully Programmed' screen will be populated and the Memory PCM can be removed and used for deployment.

Figure 64 – Successful Program screen

6.10 Programming a 'Surface Test' command using the Surface Interface

In order to check the operational performance of the **K-Set**, a 'Surface Test' can be performed, whereby the **K-Set** will pull against a test fixture, generating a load with an indication of the amount of load that has been generated. A Surface Test command can be programmed to the memory PCM from the Surface Interface by selecting the 'Surface Test' icon in the Slickline Mode screen. The Surface Test procedure is described in more detail in section *8 How to Surface Test the **K-Set*** of this manual.

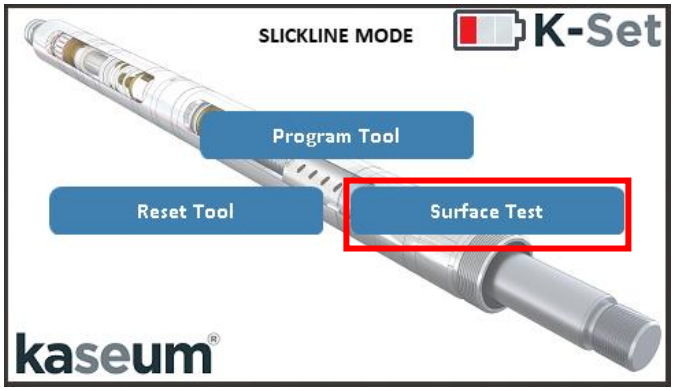


Figure 65 - Surface Test Icon

- When the 'Surface Test' icon is selected the Surface Test screen will be populated. Select the 'Surface Test' icon and the Surface Test parameters will begin downloading to the Memory PCM.

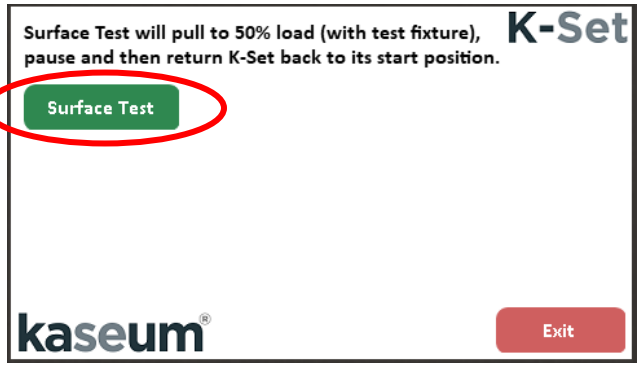


Figure 66 - Surface Test screen

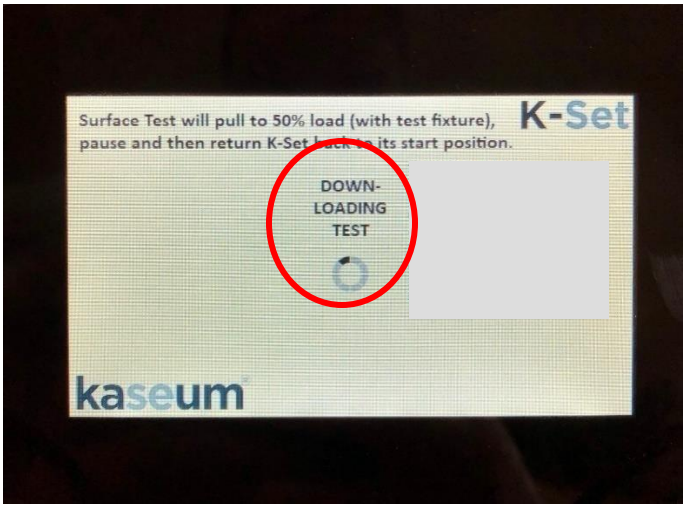


Figure 67 - Surface Test downloading in progress

- A ‘Complete’ icon will be displayed indicating the Surface Test has been successfully programmed to the PCM.

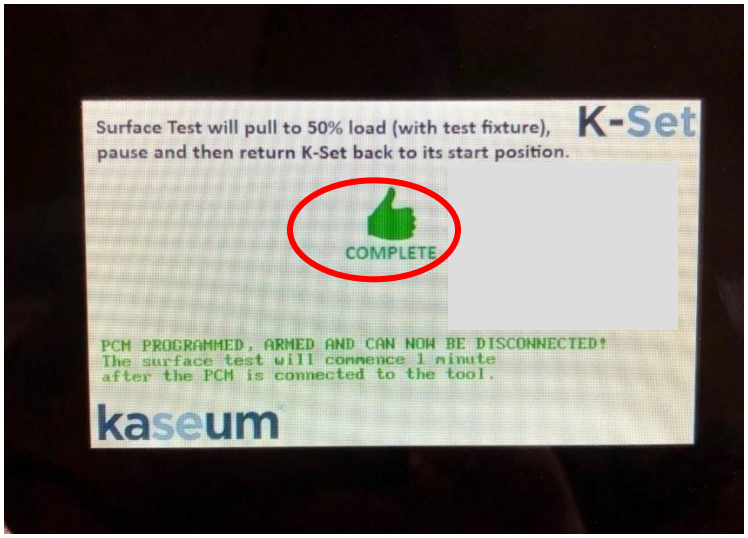


Figure 68 - Surface Test successfully programmed

6.11 Programming a ‘Reset’ command using the Surface Interface

Once the **K-Set** has completed a setting cycle it must be ‘Reset’ in order to perform the next operation. The **K-Set** is automatically ‘Reset’ by programming a PCM with the ‘Reset’ command which will automatically drive the Slick Rod back to the *Ready to Run* position. A ‘Reset Tool’ command can be programmed to the PCM from the Surface Interface by selecting the ‘Reset Tool’ icon. The physical Reset Tool procedure is described in more detail in section *9 How to Reset the **K-Set*** of this manual.

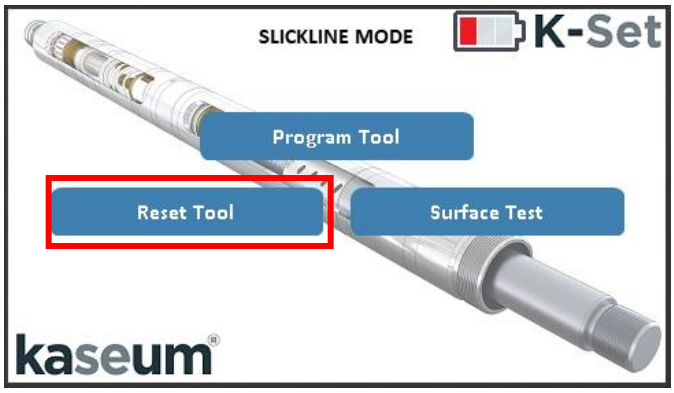


Figure 69 - Reset Tool Icon

- When the ‘Reset Tool’ icon is selected the ‘Reset Tool’ screen will be populated. Select the ‘Reset Tool’ icon and the parameters will begin downloading to the Memory PCM.

Figure 70 - Reset Tool screen

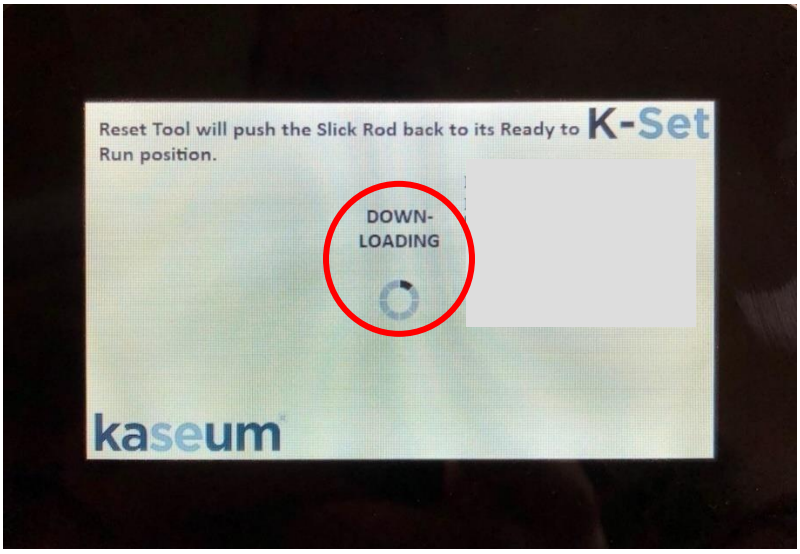


Figure 71 – Reset downloading in progress

- A ‘Complete’ message will be displayed once complete.

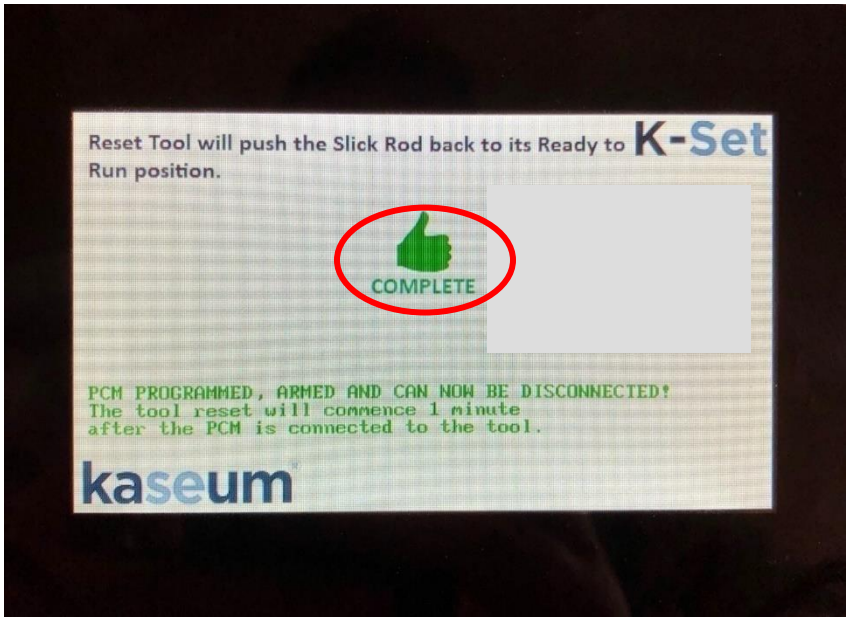


Figure 72 - Reset command successfully programmed

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7 Operating the K-Set in 'SRO Mode'

The **K-Set** has the ability to communicate to the Surface Interface allowing real-time data from the **K-Set** to be viewed, and more importantly, it allows the user to function the **K-Set** on demand.

7.1 K-Set theory of 'SRO Mode' operation

Once at the jobsite the **K-Set** can be readied for deployment. A new SRO PCM is fitted to the **K-Set** and connected to the conveyance medium. Once the **K-Set** and the Surface Interface are connected to the conveyance medium, communications to the tool can be established. A 'Surface Test' can be commanded by the user to ensure that the tool is operational prior to deployment. The **K-Set** is now fully operational and can be deployed to the required setting depth and held stationary prior to the setting cycle being initiated.

When ready, the 'Pull' command is issued by the user and the **K-Set** will begin stroking and setting the wellbore device into the wellbore. The user can connect the Surface Interface to a computer and the **K-Log** software to get a real-time graphical display of the setting cycle data. The **K-Set** will take approximately 17 minutes (Standard Length) or 26 minutes (Extended Length) to fully stroke inwards. During this time the user should check for any and all indications that the wellbore device has set and disconnected from the **K-Set** (slow current rise followed by an instant current drop, tool string weight fluctuation, pressure differences, movement on the conveyance wire etc.) and the **K-Set** should be held stationary during this setting process. Once the respective run time has expired and/or a good indication of the wellbore device being disengaged from the conveyance method is observed, then the **K-Set** can be recovered to surface.

7.2 How to command the K-Set in 'SRO Mode'

The **K-Set** is always commanded in SRO mode by the Surface Interface. The Surface Interface is used to send and receive communications only i.e. no power is delivered from surface, power is delivered by the PCM and therefore a **NEW** SRO Mode PCM must always be fitted to the **K-Set** prior to SRO mode deployment. The Surface Interface software is navigated using the central capacitive touch screen, and utilizes additional physical connections for interfacing with additional equipment (laptop or DC charger).

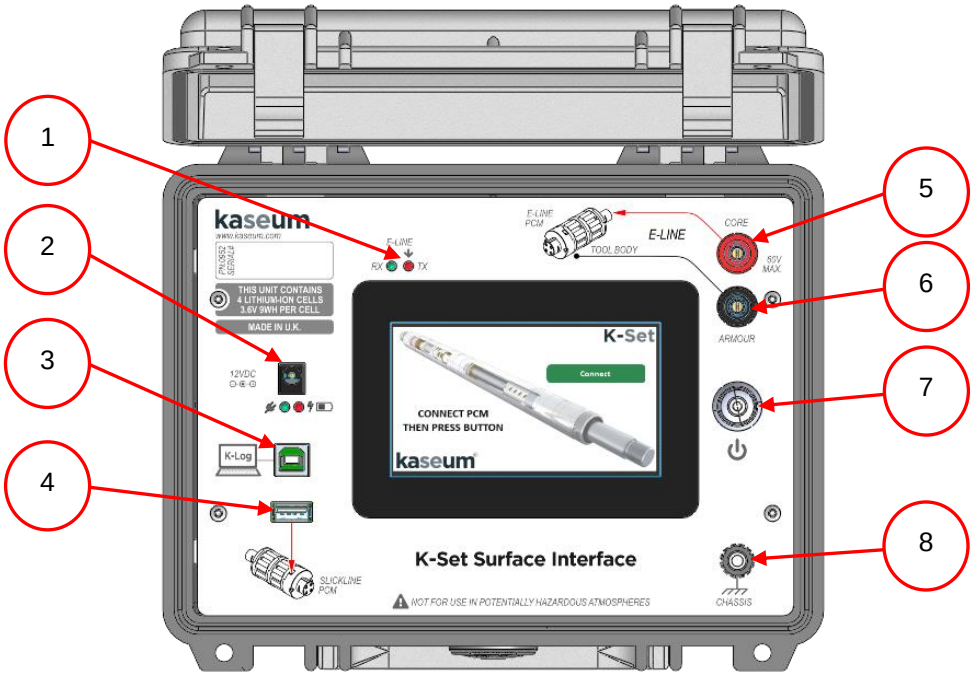

Figure 73 - Image of Surface Interface

Table 8 – Surface Interface physical connection legend

Item Number	Description	Use
1	Receive (Rx) and Transmit (Tx) LED indicators	When in SRO Mode the Receive and Transmit LED's are used as a diagnostic indication of whether the SRO communications are being sent or received.
2	12 Vdc Charging Point	This connection is used for charging the internal battery of the Surface Interface.
3	**K-**Log Data Viewing Port (USB type B)	When in SRO Mode a computer can be connected to stream the real time data for real-time graphical viewing on the **K-**Log software package.
4	Memory Mode Programming Port (USB type A)	This port allows a Memory PCM to be connected to the Surface Interface for programming.
5	E-Line Conductor (4mm Banana socket connection)	Allows connection to the wireline Conductor for use during SRO communications to the SRO PCM in real time.
6	E-Line Armour (4mm Banana socket connection)	Allows return connection to the wireline Armour for use during SRO communications to the SRO PCM in real time.
7	Power button	Turns the power to the Surface Interface ON or OFF.
8	Chassis/Ground (4mm Banana socket connection)	Allows additional safety grounding point for the Surface Interface.

7.2.1 Connecting the Surface Interface to the conveyance medium

With the SRO PCM and PCM Housing fitted to the **K-Set**, attach the conveyance medium to the **K-Set**. Connect the Surface Interface to the wireline by means of the two 4mm banana Socket connections. Communication can now be established.

- Open the Surface Interface to view the physical connections. Connect the electrical conductor of the conveyance medium to the E-Line conductor connection on the Surface Interface and connect the armour/return of the conveyance medium to the E-Line armour connection of the Surface Interface. To ensure a stable ground connection it is advisable to connect an additional ground connection to the Chassis socket connection to a suitable ground in the unit.

Figure 74 - Surface Interface connected to conveyance medium

- Select the 'Connect' icon on the Surface Interface home screen. The E-Line Mode screen will be populated.

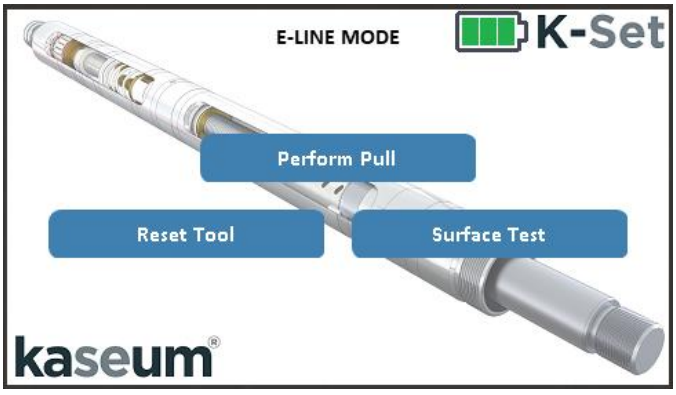

Figure 75 - Eline Mode screen

7.2.1.1 Checking the PCM prior to use.

It is advisable to check the PCM is fit for use prior to performing any of the **K-Set** functionality. To check the PCM is suitable:

- Select the 'Perform Pull' command Icon.

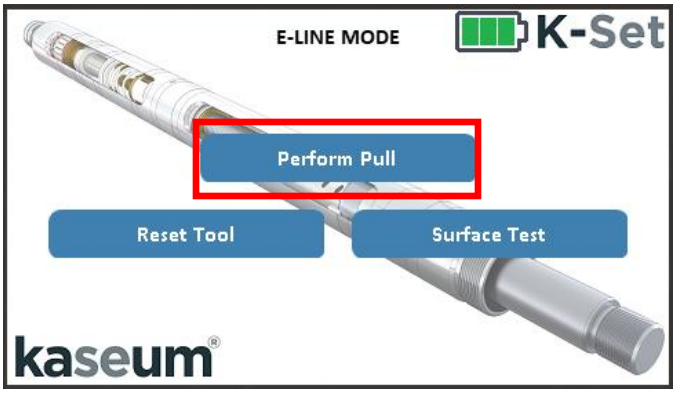

Figure 76 - Perform Pull command icon

- The Real Time Data screen will be populated. Check that the populated Battery Voltage is greater than **32 Volts. If this value is less than 32 Volts then the PCM should be not be used**

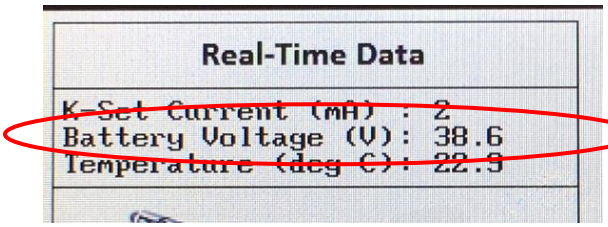

Figure 77 - Real Time Data screen

- If the Battery Voltage is greater than 32 Volts then select the 'Back' command icon to return to the E-Line Mode Home screen.

The following functionality can be accessed through the E-Line Mode Home screen:

7.2.2 Real Time command and control using the Surface Interface

The main functionality of the **K-Set** is accessed through the 'Perform Pull' icon. When this 'Perform Pull' icon is selected, the real-time data, along with the 'Pull' command are accessed:

- Select the 'Perform Pull' icon.

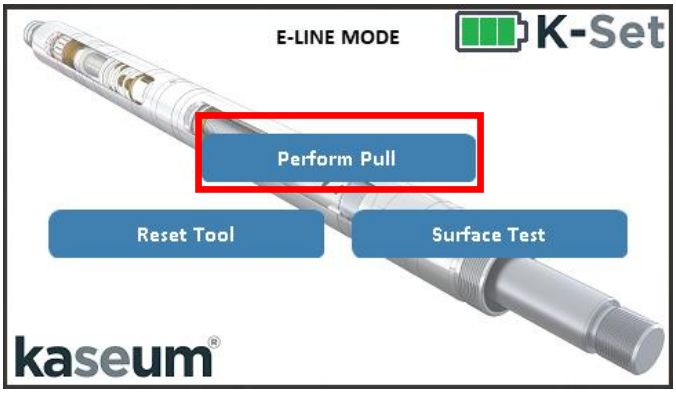

Figure 78 – Perform Pull icon

- The Real Time Data screen will be displayed. Real time channel data from the **K-Set** will be populated on the left-hand side of the screen, which is updated every second. There is also a graphic image of the **K-Set** along with the current running status. When the **K-Set** motor is running the status message will read '**K-Set** ON'. When the **K-Set** motor is off and populating data only then the message '**K-Set** OFF' will be observed. On the right-hand side of the screen there is a run timer which will begin counting down from 40 minutes (40 minutes is the default run time for a 'Pull' command) once the 'Pull' command is issued, as well as the default maximum Current Limit.

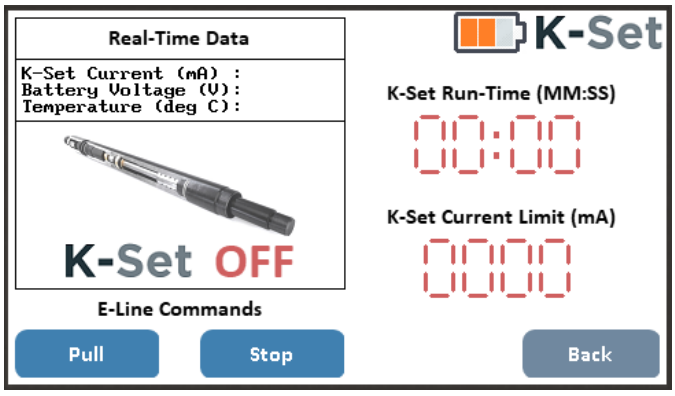

Figure 79 – Real Time Data screen format

- Along the bottom of the screen there are 3 icons that can be selected by the user. They are:
  - **Pull**. The 'Pull' icon issues the Pull (set) command to the **K-Set**. Once the icon has been selected an additional confirmation screen will be displayed, ensuring confirmation that this command is indeed to be sent.

Figure 80 - Pull Command warning

- If the command is to be sent then the 'Yes' icon is to be selected. The Perform Pull screen will then be refreshed and the **'K-Set** ON' image will appear and the countdown timer will begin counting down.

Figure 81 - Image showing K-Set ON message.

- If the command is not to be sent then 'No' should be selected and the screen will return to the E-Line Mode screen.

No power is sent from the Surface Interface to the **K-Set**, only communication signals. Once the 'Pull' command has been issued the **K-Set** will continue to perform the 'Pull' command until either the maximum motor run time (i.e. 40 minutes) or the maximum default current limit (i.e. 2500mA) has been reached, regardless if communication to the Surface Interface is maintained or lost.

- **Stop**. The 'Stop' icon will stop setting cycle (i.e. turn off the **K-Set** motor) if it is performing a pull (set) command. If the 'Pull' command is to be stopped then select the 'Stop' icon, a warning screen will be displayed and the stop command will be issued immediately.

Figure 82 - Stop command warning message

- **Back**. The 'Back' icon will return the user back to the E-Line Mode screen.

7.2.3 Performing a Surface Test using the Surface Interface

In order to check the operational performance of the **K-Set**, a 'Surface Test' can be performed, whereby the **K-Set** will pull against a test fixture, generating a load and an indication of the amount of load that has been generated. A Surface Test command can be commanded from the Surface Interface by selecting the 'Surface Test' icon. The physical Surface Test is described in more detail in section *8 How to Surface Test the **K-Set*** of this manual.

Prior to commanding the Surface Test, the user must fit the Force Gauge Assembly to the slick rod end of the **K-Set**.

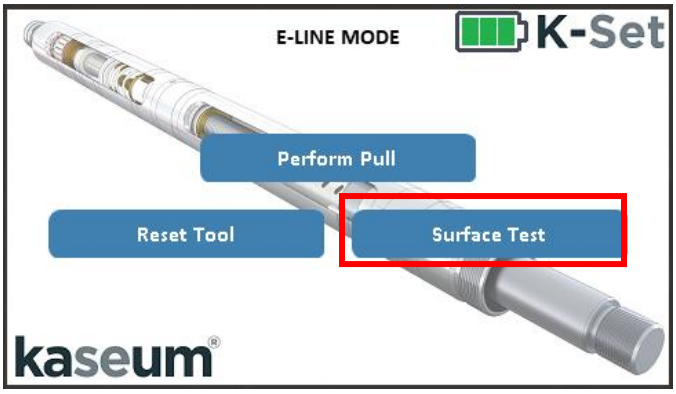

Figure 83 - Surface Test Icon

- When the 'Surface Test' icon is selected the Surface Test Screen will be displayed. Select the 'Surface Test' icon and the Surface Test will begin immediately.

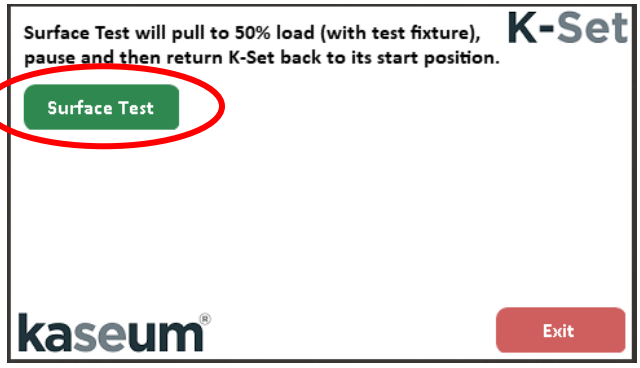

Figure 84 - Surface Test screen

- The ‘Surface Test’ can be aborted when running by selecting the ‘Abort’ icon.

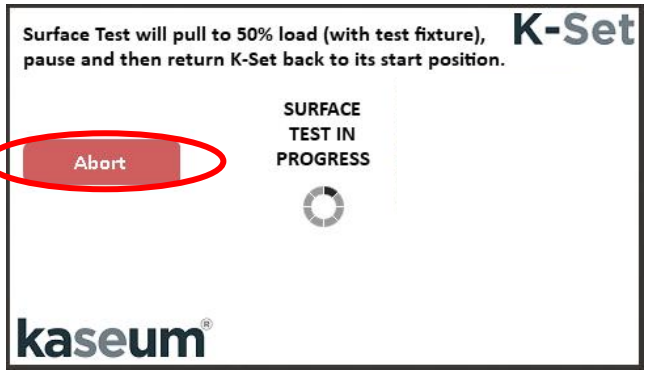

Figure 85 - Abort icon

- A ‘Complete’ icon will be displayed indicating the Surface Test has been completed.

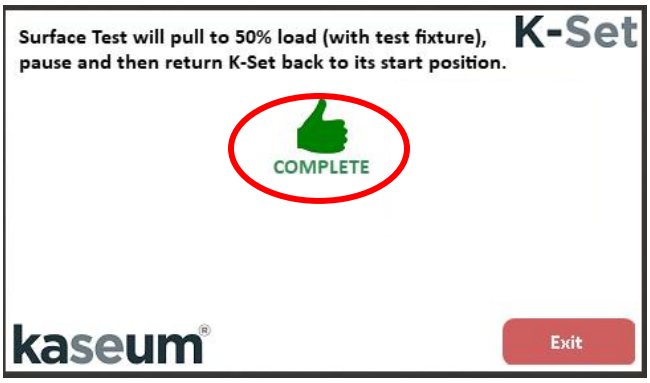

Figure 86 - Successful Surface Test

7.2.4 Performing a Reset using the Surface Interface

Once the **K-Set** has completed a setting cycle it must be 'Reset' in order to perform the next operation. The **K-Set** is automatically 'Reset' by sending a 'Reset' command which will automatically drive the Slick Rod back to the *Ready to Run* position. The physical Reset Tool procedure is described in more detail in section *9 How to Reset the **K-Set*** of this manual.

- With the **K-Set** connected to the Surface Interface select the 'Reset Tool' icon.

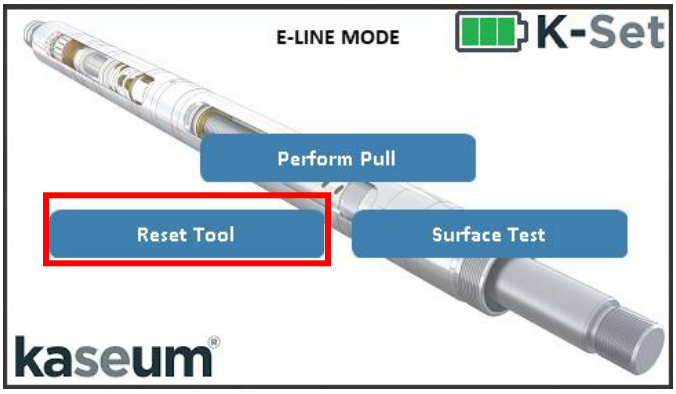

Figure 87 - Reset Tool Icon

- When the 'Reset Tool' icon is selected the Reset Tool screen will be populated. Select the 'Reset Tool' icon and the **K-Set** will begin resetting immediately.

Figure 88 - Reset Tool screen

- The 'Reset' command can be aborted when running by selecting the 'Abort' icon.

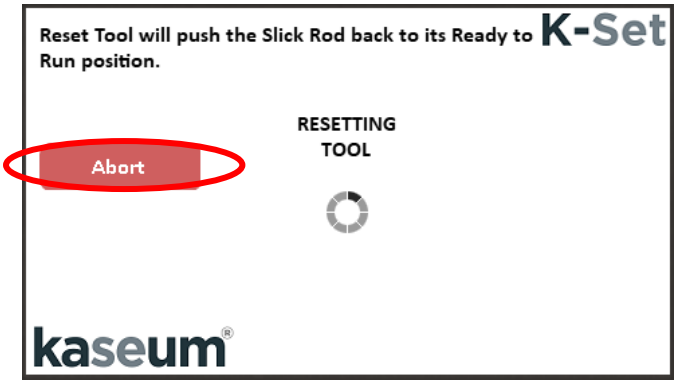

Figure 89 - Abort icon

- A ‘Complete’ message will be displayed once complete.

Figure 90 - Reset command complete

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8 How to Surface Test the K-Set

It is recommended that the **K-Set**'s function is checked periodically to ensure that the performance remains sufficient for operational use. This can be achieved by means of a simple load test, whereby the **K-Set** is commanded to perform a dummy setting cycle whilst pulling against a hydraulic piston. A Force Gauge Assembly (**kaseum** part number 001553) acts as the hydraulic piston during this test and when fitted to the **K-Set** the Force Gauge Assembly will give a quantitative indication of the load generated. The Force Gauge Assembly is a combined piston arrangement with force display that is anchored to the Slick Rod and pulled against the Outer Adaptor end face when the **K-Set** is performing a 'Pull' command.

Once the 'Surface Test' command has been initiated, the **K-Set** will pull to a nominal force/current limit and then power down. The following table indicates the amount of force that will be generated by the 'Surface Test' command and the acceptable limit that will indicate a successful test:

Table 9 - Surface Test result table

K-Set OD Size	Force Gauge Assembly to be used	Piston Area of Force Gauge Assembly	Expected Pressure Gauge reading	Acceptable Pressure Gauge Range	Resultant force (Pressure x Piston Area)
2.125"	001553	5in^2	3,000psi	≥ 2700 psi	≥ 13,500lb

After a delay of 10 seconds the **K-Set** will then automatically 'Reset' to the 'Ready to Run' position. **kaseum** recommends that this 'Surface Test' is performed frequently, ideally before each deployment, to ensure correct function of the **K-Set**. If the **K-Set** 'Surface Test' does not yield a result within the specification listed in the above table then the 'Surface Test' should be repeated. If after two attempts it still fails to reach the acceptable figure then it should **NOT** be used, and quarantined for further investigation. If there is any doubt about the **K-Set** performance contact your **kaseum** representative or email Info@kaseum.com

Figure 91 - Force Gauge Assembly image

The following steps outline the 'Surface Test' procedure:

1. Screw the Force Gauge Assembly (**kaseum** part number 001553) onto the Slick Rod by hand until it contacts the Outer Adaptor. Back off the Force Gauge Assembly by ½ a revolution. If required a 5/8" Allen Key can be used to assist in the fitting of the Force Gauge Assembly.
2. Choose a new PCM to perform the 'Surface Test'. Note that the PCM is a single use article and should only ever be used for a single 'Surface Test' and a single downhole setting cycle. **DO NOT** use a depleted PCM as this **WILL** give erroneous surface test results.

IF USING IN MEMORY MODE

3. Program the PCM or command the Surface Test procedure the PCM with the 'Surface Test' command.
    - To program a 'Surface Test' command using the **K-Log** software application reference section *6.7 Programming a Surface Test using K-Log software* of this manual for guidance.
    - To program a 'Surface Test' command using the Surface Interface reference section *6.10 Programming a 'Surface Test' command using the Surface Interface* of this manual for guidance.
4. With the alignment key in the PCM oriented to the mating keyway in the Motor Module, connect the PCM to the Motor Module. After a 5 second initialization period the diagnostic LED in the PCM will begin flashing, indicating that the **K-Set** is in Countdown Timer mode. After a 1-minute time delay the **K-Set** will power on and the Slick Rod will begin stroking inwards.

IF USING IN SRO MODE

5. Connect the **K-Set** to the Surface Interface and establish communications.
6. Select the Surface Test Icon to open the Surface Test screen. Select the 'Surface Test' Icon and once acknowledged the Slick Rod will begin stroking inwards.

7. Once the Force Gauge Assembly bottoms out on the Outer Adaptor end face it will begin loading the Force Gauge Assembly and then power down. This load will be held for a maximum of 10 seconds. During this time note the pressure on the Force Gauge and check it is within specification as per *Table 9 - Surface Test result table.*
8. After 10 seconds the **K-Set** will power back up and will 'Reset' back to its *Ready to Run* position and then power down. Remove the Force Gauge Assembly.
9. Measure the distance from the end of the Slick Rod to the Outer Adaptor end face to check the tool is in its *Ready to Run* position. The size should be as follows:

Table 10 - *Ready to Run* distance table

K-Set OD size	Distance between end of slick rod and outer adaptor
2.125"	5" ± 0.4" (127mm ± 10mm)

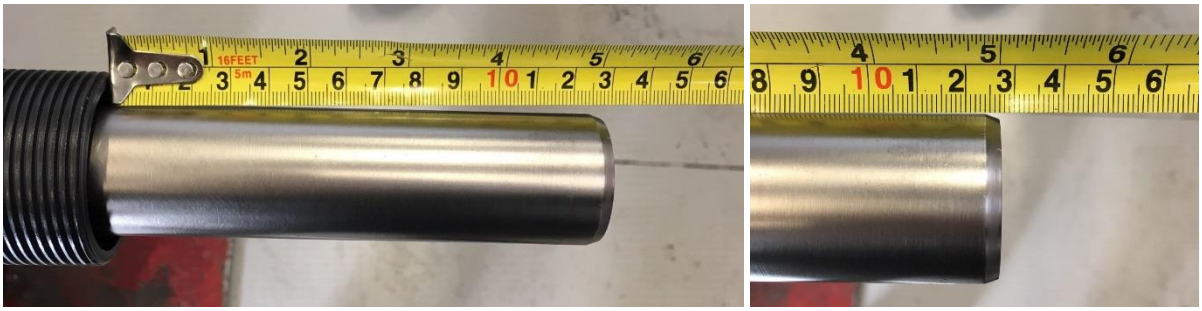

Figure 92 – *Ready to Run* spacing

9 How to Reset the K-Set

After the **K-Set** has completed the setting cycle the Slick Rod will be fully retracted inside the Outer Adaptor. The user must 'Reset' the **K-Set** in order to ready it for future deployments. A 'Reset' is in essence running the **K-Set** in reverse, which will stroke the Slick Rod back to its original *Ready to Run* position. This function is electronically controlled and requires no user mechanical intervention. The 'Reset' function is not operation critical, and as such an old or used PCM should be utilized to perform this function.

To perform a 'Reset' the following steps should be carried out:

IF USING IN MEMORY MODE

1. Program the PCM with the 'Reset' command.
    - To program a 'Reset' command using the **K-Log** software application reference section *6.6 Programming a Reset command using **K-Log** software* of this manual for guidance.
    - To program a 'Reset' command using the Surface Interface reference section *6.11 Programming a 'Reset' command using the Surface Interface* of this manual for guidance.
2. With the alignment key in the PCM oriented to the mating keyway in the Motor Module, connect the PCM to the Motor Module. After a 5 second initialization period the diagnostic LED will begin flashing. After a further 60 second delay the **K-Set** will power up and begin stroking the Slick Rod outwards.

IF USING IN SRO MODE

3. Connect the **K-Set** to the Surface Interface and establish communications.
4. Select the Reset Tool Icon to open the Reset Tool screen. Select the 'Reset tool' Icon and once acknowledged the Slick Rod will begin stroking outwards.

5. The **K-Set** will continue to run until the Slick Rod is bottomed out and in the *Ready to Run* position. Once fully Reset the **K-Set** will power down. Measure the distance from the end of the Slick Rod to the Outer Adaptor end face (see *Figure 93 – Ready to Run spacing* below for reference) and check the **K-Set** is in its *Ready to Run* position. The size should be 127mm ± 10mm.
6. If this distance measures smaller than 117mm then the user should repeat the above steps 1 through 5. If after several repeated 'Reset' attempts the **K-Set** still does not measure the correct *Ready to Run* distance then the **K-Set** should be removed from service and quarantined for investigation.

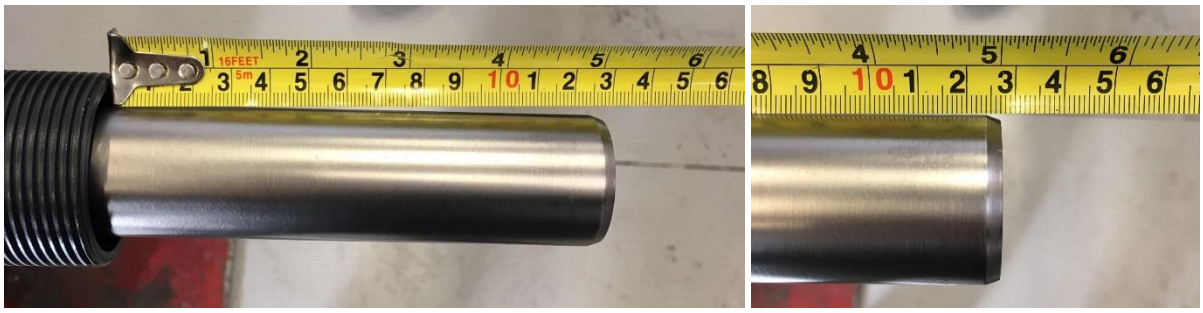

Figure 93 – *Ready to Run* spacing

10 Field User Golden Rules

The following statements have been highlighted for the field user as 'Golden Rules' in the successful operation of **K-Set**. Adhering to these rules will ensure that the tool is used correctly, therefore maximizing operational efficiency

- **The PCM should only be used ONCE**. The PCM is a single use item and a new PCM should be used for each operation. The PCM is designed with enough redundancy to carry out 1 x deck test, 1 x full stroke job (max 12hrs in hole) and 1 x 'Reset'. Re-using a PCM that has already been deployed in a setting operation **WILL RESULT IN MIS-RUNS AND MAY RESULT IN A PARTIAL SET SITUATION**
- **DO NOT use any tooling on the Slick Rod**. The Slick Rod is a dynamic sealing surface and it is **IMPERATVE** that the Slick Rod is not marked, damaged or clamped on. **When making up/breaking out Inner Running Adaptors to the Slick Rod use the Linear Actuator Housing as a back-up point. DO NOT torque through connections.** The Slick Rod is keyed into the Linear Actuator Housing, so this is the most suitable back-up point when tightening Adaptors to the Slick Rod.

Figure 94 - Slick Rod location

- **DO NOT breakout the external connections below the Motor Module**. The external pressure Housings and Subs have a metal seal in addition to the elastomeric seals, and for these to function correctly it is important that the external connections remain tight and are not broken out. If an external connection is found broken out or slack then then it is recommended to fully break out the connection and replace the elastomeric seals and refit the connection. All the O-Rings and Back-Up rings on the **K-Set** main body threads are identical.

  These Housings and Subs should be made up to a minimum torque of 100lb.ft

  For guidance on module removal and replacement reference section *14 Re-Torqueing of broken out* **K-Set** *Connections*.
- **When making up/breaking out Setting Sleeve Running Adaptors use the Outer Adaptor as a backup point. DO NOT torque through connections**.
- **When making up the PCM Housing use the Motor Sub as a backup point**. **DO NOT torque through connections.**
- The Gearbox Module to Linear Actuator Module connection is a **LEFT-HAND THREAD MAKE UP**.
- When using the **K-Set** in Memory Mode and if deployed in a hot environment, then the Countdown Timer may experience a small amount of time drift. As a rule of thumb, if the expected well temperature is greater than 80°C then the user should allow up to an additional 3%-time delay in the Countdown Timer (i.e. when waiting for the setting cycle to complete wait an additional 2 minutes for each 60 minutes programmed).

11 Recommended Operating Instruction for Memory Mode

The following section provides a step by step breakdown of a recommend operational cycle of the **K-Set** in Memory Mode.

11.1 Prepare the K-Set

1. Secure the **K-Set** on tool stands or a pipe vice if available. Inspect the **K-Set** visually for any signs of damage.
2. While holding the Motor Module stationary, un-screw the PCM Housing. Inspect the condition of the O-rings and Back-Up rings on the Motor Module, ensuring they are suitable for deployment, Kaseum recommend that these O-Rings are changed every run and Back-Up rings are changed if damaged.
3. Select a new Memory PCM.
4. Perform a 'Surface Test'. Reference section *8 How to Surface Test the* ***K-Set*** of this manual for guidance.

11.2 Fitting of the Wellbore Device

5. Carefully fit the Inner Running Adaptor to the Slick Rod of the **K-Set.** Tighten the Adaptor as recommended by the wellbore device/plug manufacturers' specification. When tightening the Inner Running Adaptor hold the Linear Actuator Housing as a backup point. If retaining set screws are present then they should be tightened at this point.

DO NOT use any tooling on the Slick Rod. The Slick Rod is a dynamic sealing surface and it is **IMPERATVE** that the Slick Rod is not marked, damaged or clamped on.

6. Carefully fit the Setting Sleeve Running Adaptor to the Outer Adaptor of the **K-Set.** Space out and tighten the Setting Sleeve Running Adaptor as recommend by the wellbore device/plug manufacturers' specification. When tightening the Setting Sleeve Running Adaptor hold the Outer Adaptor as a backup point. If retaining set screws are present then they should be tightened at this point.

11.3 Programming the PCM

7. Connect the Memory PCM to the **K-Log** software application or the Surface Interface and program a Countdown Timer. Reference section *6.4 How to Program/Perform Pull in 'Memory Mode' using* **K-Log** Or section *6.9 Programming a Countdown Timer Delay using the Surface Interface 'Program Tool' command* for guidance
8. Once the Countdown Timer has been programmed then remove the PCM from the programming port and store safely for deployment.

11.4 Fitting PCM

9. Once the **K-Set** is ready to be deployed align and fit the Memory PCM to the **K-Set** main tool assembly, taking note of the exact time that the PCM was connected.

ONCE THE PCM IS CONNECTED TO THE K-Set AND THE LED HAS BEGUN FLASHING THE COUNTDOWN TIMER HAS BEGUN.

In Memory Mode, once the **K-Set** begins the setting stroke it cannot be stopped.

Arming Code. The **K-Set** protects against power glitches by means of a unique electronic arming code. This code is detected when the memory PCM is initially connected to the **K-Set** main tool assembly. Once detected this code is read and deleted, and the **K-Set** will operate as programmed. If there is a power glitch, or the PCM is removed from the **K-Set** main tool assembly and re attached, the code will not be present during the initialization sequence and the **K-Set** will not operate. The user must always ensure that the Memory PCM is not fitted and removed multiple times before the operation and that a valid diagnostic LED signal is observed prior to deployment.

10. Ensure that the diagnostic LED confidence check is observed as per *Table 6 - LED diagnostic indication legend.*
11. Whilst holding the Motor Module stationary screw on the PCM Housing (and Top Crossover if not already fitted.)

11.5 Deployment of the K-Set

Maximum Running Speed. The maximum recommended running speed for the **K-Set** is 150ft/min or 50m/min. Running the tool faster than this may cause damage or shock to the tool that may adversely affect the correct function of the tool.

12. The **K-Set** should be run into the correct setting depth and held stationary prior to the Countdown Timer expiring. Once the Countdown Timer has expired the setting cycle will begin.

13. Allow at least 40 minutes for the setting cycle to be conducted. During this time monitor all available signs for successful set and disengagement of the wellbore device. (Weight indicator fluctuations, pressure changes, movement on the conveyance medium etc.)

If the **K-Set** is operated in a hot environment then the Countdown Timer may experience a small amount of time drift. As a rule of thumb, if the expected well temperature is greater than 80°C then the user should allow an additional 3%-time delay in the Countdown Timer (i.e. wait an additional 2 minutes for each 60 minutes programmed for the setting cycle to be completed.)

14. Once a successful operation has been established, or once the Countdown Timer and an additional 40 minutes have elapsed, the **K-Set** can be recovered to surface.

11.6 Post Run Requirement

15. Once the **K-Set** is removed from the wellbore and running string, secure in a pipe vice or tool stands. Clean down tool and inspect for signs of damage.
16. Whilst holding the Motor Module stationary, un-screw the PCM Housing. The PCM can now be removed from the **K-Set**.
17. Retrieve tool data from the PCM.
    - Connect the PCM and the Computer via the supplied USB Interface Cable. Allow time for the PCM to initialize. (i.e. wait for the green LED to be permanently illuminated).
    - Launch the **K-Log** software application.
    - Load the correct Job Folder.
    - Identify the correct comms port and select the 'Identify Tool' Command.
    - Select the Upload Data from Tool command icon. The software will upload data from the PCM and the saved tool data and will saved as an ASCII .csv file in the Job folder.
    - This data can be viewed in the **K-Log** Chart window. In the **K-Log** home screen select the 'Chart' icon and then select the 'Load CSV to Chart' option. Navigate the file explorer to the data file that has just been uploaded and a graphical representation of the operation will be populated for analysis.

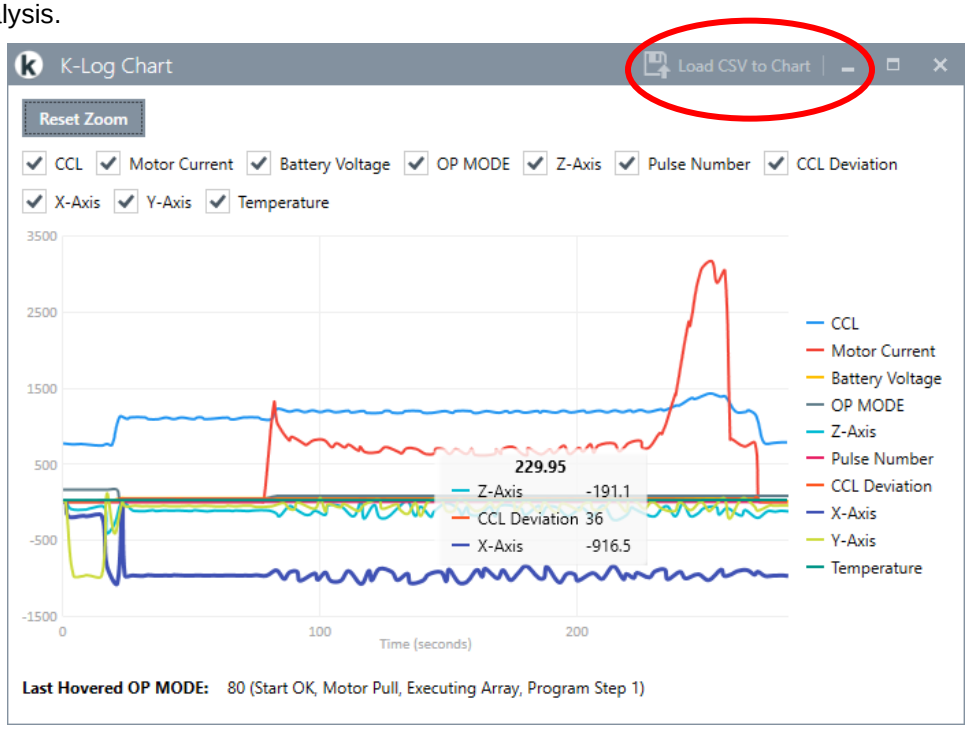

Figure 95 - Chart View and location of 'Load CSV to Chart' icon

18. The **K-Set** can now be 'Reset' ready for the next operation. Program a 'Reset' command to the PCM using the Surface Interface or the **K-Log** Software. Align and fit the Memory PCM to the **K-Set** main tool assembly and wait till the Reset command begins. The tool will begin stroking outwards until it hits the *Ready to Run* position and powers down.
19. Once the **K-Set** is 'Reset' remove all Running Adaptors ensuring that any retaining set screws are removed prior to breaking out. Measure that the distance from the end of the Slick Rod to the Outer Adaptor is 127mm (±10mm). The **K-Set** is now Reset, ready for the next operation. Remove the PCM Housing and Memory PCM. The Memory PCM should be discarded if it has been used for a live run.

DO NOT use any tooling on the Slick Rod.

When making up/breaking out Inner Running Adaptors to the Slick Rod use the Linear Actuator Housing as a back-up point. DO NOT torque through connections.

When making up/breaking out Setting Sleeve Running Adaptors use the Outer Adaptor as a backup point. DO NOT torque through connections.

12 Recommended Operating Instruction for SRO Mode

The following section provides a step by step breakdown of a recommend operational cycle of the **K-Set** in SRO Mode.

12.1 Prepare the K-Set

1. Secure the **K-Set** securely on tool stands or a pipe vice if available. Inspect the **K-Set** visually for any signs of damage.
2. While holding the Motor Module stationary, un-screw the PCM Housing. Inspect the condition of the O-rings and Back-Up rings on the Motor Module, ensuring they are suitable for deployment.
3. Select a new SRO PCM and align the orientation Key and fit to the Motor Module. Re-fit the PCM Housing using the Motor Module. Fit the Cablehead to the top of the PCM Housing.
4. Patch in the Surface Interface to the wireline and establish communications with the **K-Set.** Once communications have been established perform a Surface Test, reference *section 7.2.3 Programming a 'Surface Test' command using the Surface Interface* of this manual for guidance.

12.2 Fitting of the Wellbore Device

5. Carefully fit the Inner Running Adaptor to the Slick Rod of the **K-Set.** Tighten the Adaptor as recommend by the wellbore device/plug manufacturers' specification. When tightening the Inner Running Adaptor hold the Linear Actuator Housing as a backup point. If retaining set screws are present then they should be tightened at this point.

DO NOT use any tooling on the Slick Rod. The Slick Rod is a dynamic sealing surface and it is **IMPERATIVE** that the Slick Rod is not marked, damaged or clamped on.

6. Carefully fit the Setting Sleeve Running Adaptor to the Outer Adaptor of the **K-Set.** Space out and tighten the Setting Sleeve Running Adaptor as recommend by the wellbore device/plug manufacturers' specification. When tightening the Setting Sleeve Running Adaptor hold the Outer Adaptor as a backup point. If retaining set screws are present then they should be tightened at this point.

12.3 Deployment of the K-Set

Maximum Running Speed. The maximum recommended running speed for the **K-Set** is 150ft/min. Running the tool faster than this may cause damage or shock to the tool that may adversely affect the correct function of the tool.

7. The **K-Set** should be run into the correct setting depth and held stationary prior setting the wellbore device. To initiate the Setting of the device, select 'Perform Pull' on the Surface Interface and the setting sequence will begin.

8. Once the **K-Set** is running monitor the Current on the screen for signs of the wellbore device setting (a constant increase in Current over the initial running Current) and also signs that the wellbore device has disengaged (sharp drop in Current). During this time monitor all additional signs for successful set and disengagement of the wellbore device. (Weight indicator fluctuations, pressure changes, movement on the conveyance medium etc.) Allow at least 40 minutes for the setting cycle to be conducted.

The **K-Set** Current value is a good indication of how the setting cycle is progressing as the **K-Set** Current is proportional to the generated load. The **K-Set** benefits from hydrostatic assistance, meaning that the higher the pressure in the Well the less work (and therefore less Current) the **K-Set** will need to perform. This means that in operations with high hydrostatic pressure the **K-Set** Current value may not give a clear indication that the wellbore device has disconnected and the user should always utilise additional indications that the wellbore device has disengaged (Weight fluctuation, pressure change etc.) If in any doubt then wait at least 40 minutes after the 'Pull' command has been acknowledged before trying to POOH.

9. Once a successful operation has been established, or once 40 minutes have expired after the 'Pull' command was acknowledged, the **K-Set** can be recovered to surface.

12.4 Post Run Requirement

10. Once the **K-Set** is removed from the wellbore and running string, secure in a pipe vice or tool stands. Clean down tool and inspect for signs of damage.
11. Whilst holding the Motor Module stationary, un-screw the PCM Housing. The SRO PCM can now be removed from the **K-Set.**
12. Retrieve tool data from the SRO PCM if required.
    - Connect the SRO PCM and the Computer via the supplied USB Interface Cable. Allow time for the PCM to initialize. (i.e. wait for the green LED to be permanently illuminated).
    - Launch the **K-Log** software application.
    - Create a Job Folder.
    - Identify the correct comms port and select the 'Identify Tool' Command.
    - Select the Upload Data from Tool command icon. The software will upload data from the SRO PCM and the saved tool data and will saved as an ASCII .csv file in the Job folder.
    - This data can be viewed in the **K-Log** Chart window. In the **K-Log** home screen select the 'Chart' icon and then select the 'Load CSV to Chart' option. Navigate the file explorer to the data file that has just been uploaded and a graphical representation of the operation will be populated for analysis.

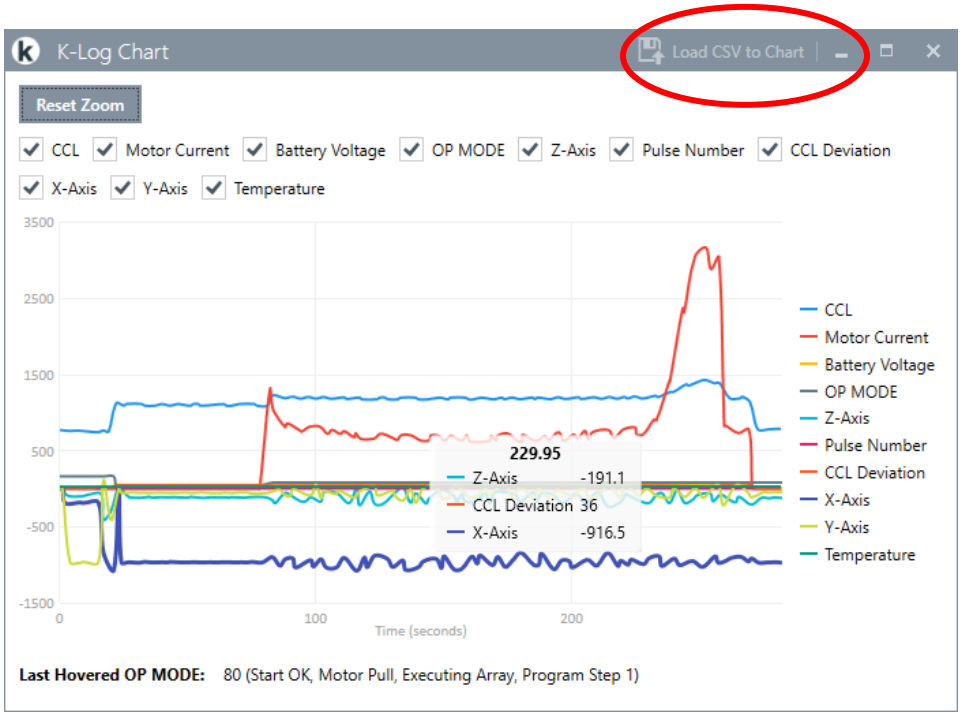

Figure 96 - Chart View and location of 'Load CSV to Chart' icon

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13. The **K-Set** can now be 'Reset' ready for the next operation. Re-fit the used SRO PCM and PCM Housing. Connect the Cablehead and establish communication through the Surface Interface. Select the 'Reset Tool' command.
14. Once acknowledged the Slick Rod will begin stroking outward and will run back to the *Ready to Run* position and power down. Remove all Running Adaptors ensuring that any retaining set screws are removed prior to breaking out any Adaptors.
15. Measure that the distance from the end of the Slick Rod to the Outer Adaptor is 127mm (±10mm). The **K-Set** is now reset ready for the next operation. Remove the Cablehead and PCM Housing. Remove the SRO PCM and discard if it has been used for a live run.

DO NOT use any tooling on the Slick Rod.

When making up/breaking out Inner Running Adaptors to the Slick Rod use the Linear Actuator Housing as a back-up point. DO NOT torque through connections.

When making up/breaking out Setting Sleeve Running Adaptors use the Outer Adaptor as a backup point. DO NOT torque through connections.

13 Field User Interpretation of the Logged data.

When the PCM data is uploaded it can be viewed in the **K-Log** Chart window. There are multiple channels that are logged during the setting cycle. They are:

Table 11 - Logged Data channel description

Channel Description	Purpose
CCL	If a CCL is connected to the **K-Set** then the raw CCL data will be saved to this channel. **Warning.** It is NOT recommended to use a shooting CCL or a powered correlation device when using the **K-Set** Set in SRO mode as these may affect the transmission and receiving of tool communications. If a correlation device is to be used then a non-powered logging or correlation CCL (i.e. a CCL without internal diodes) is recommended. This CCL should be function checked in the string prior to R.I.H to ensure there is no communication issue to and from the **K-Set.** The **K-Set** can be used with a shooting CCL in Memory Mode for Correlation post run. It is recommended to use the shooting CCL upside down to negate any interference from the internal diodes of the shooting CCL.
Motor Current	This is the single most important logged channel for the user. The motor current is directly proportional to the load that is being generated by the **K-Set.** Once the **K-Set** disconnects from the wellbore device this is represented by a sudden drop in motor current. The **K-Set** is assisted by hydrostatic pressure (i.e. hydrostatic pressure will assist in the setting cycle and reduce the amount of load, and therefore motor current on the tool). This means that the motor current achieved will vary depending on the amount of hydrostatic pressure available. As a rule, for every 1000psi of hydrostatic pressure this will equate to 1490lb of load assistance.
Battery Voltage	Indication of the battery Voltage present in the PCM.
Op Mode and array index	Diagnostic aid in determining what operation the **K-Set** is performing. When the logged data is viewed in the Chart window there is a description of this channel populated at the bottom of the Chart, which tells the user the current state of the **K-Set** at specific times of the setting cycle.
Z axis Accel	Acceleration reading from the PCM along the long axis of the **K-Set.**
Pulse number	A diagnostic aid determining what acceleration pulse array step the **K-Set** is performing.
CCL Deviation	Secondary CCL channel, this channel logs the difference between CCL readings.
X Axis Accel	Additional acceleration reading along the short axis of the **K-Set.**
Y Axis Accel	Additional acceleration reading along the short axis of the **K-Set**, perpendicular to the X Axis Accel.
Temperature	Temperature of the PCM internal electronics.

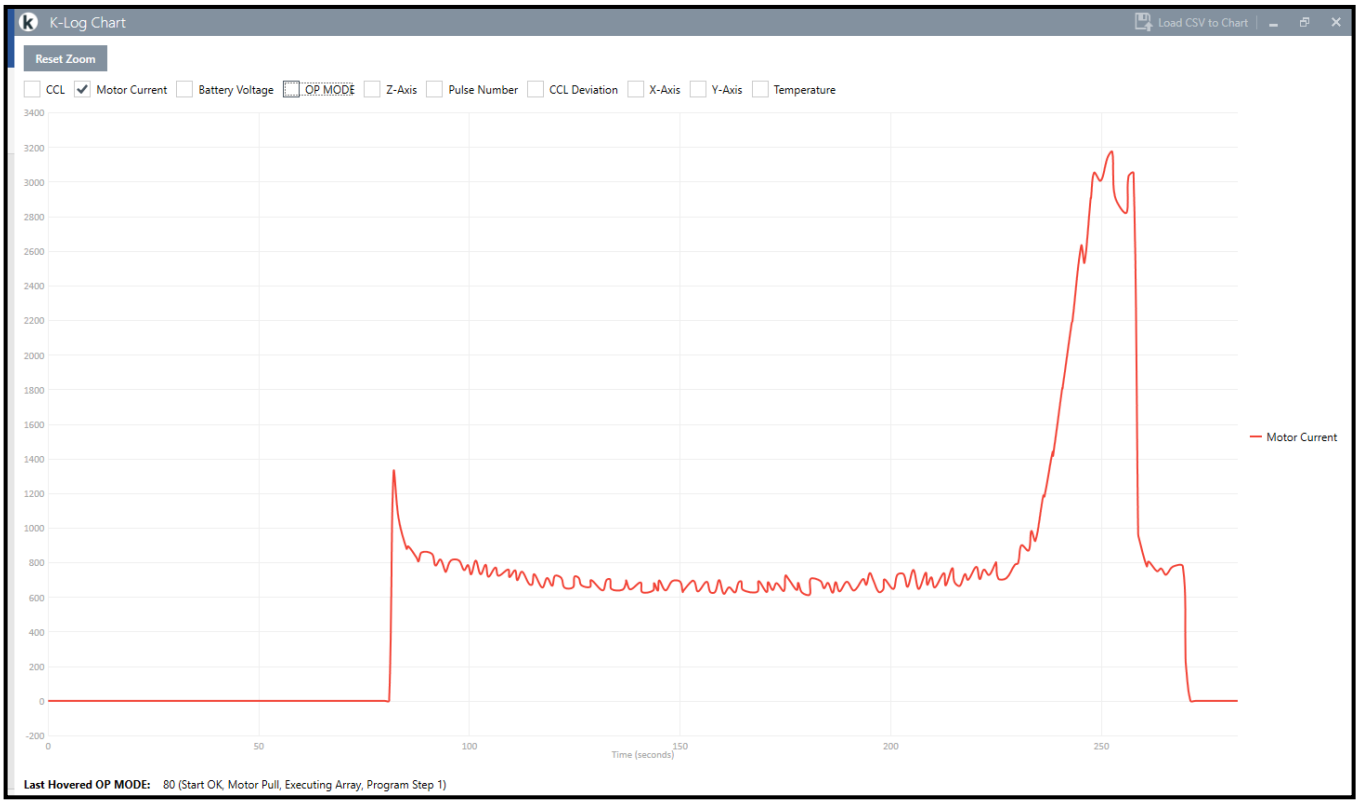


Figure 97 - Example of a Motor Current profile during a setting cycle with low hydrostatic assistance

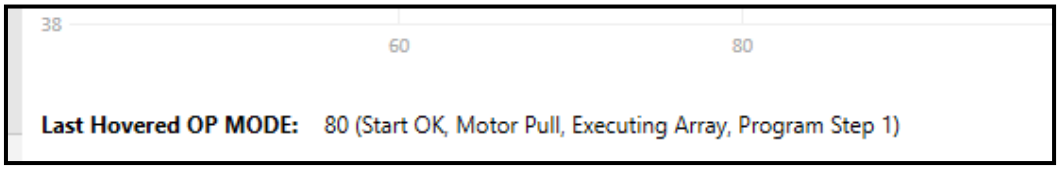


Figure 98 - Example of a setting cycle diagnostic OP mode as viewed in the Chart window

14 Re-Torqueing of broken out K-Set Connections

During normal use of the **K-Set** only the PCM Housing needs to be removed during normal use. If any of the other **K-Set** connections become un-torqued during service then they must be serviced and re-fitted. All the **K-Set** main body connections use identical O-Rings and Back-Up rings.

All the **K-Set** external connections use identical O-Rings and Back-up rings.

14.1 Motor Module Removal/Re-fit

If the Motor Module and Gearbox Module connection becomes un-torqued then it is recommended to fully break out the connection and inspect the sealing arrangement. It is recommended that as a minimum the O-Rings are replaced.

Removal

- While holding the Gearbox Module, un-screw the Motor Module fully. This will allow access to the Motor Module seals. Remove all O-rings and Back-Up rings using a non-metallic O-ring pick or similar, and clean all sealing surfaces. It is recommended that the O-Rings are discarded and replaced. The Back-Up rings should be inspected for damage and may be reused if they are deemed in an acceptable condition.
- Fit the O-rings and Back-Up rings to the Motor Module ensuring the correct orientation (i.e. O-ring to the pressure side of the connection, concave side of the Back-Up ring to the O-ring). Apply a light coat of grease to the O-rings and thread.

Re-fit

- When assembling the Motor Module to the Gearbox Module ensure that the Motor Module is in the correct orientation (The four Electrical Contacts should be facing upwards and the spring-loaded Coupling should be facing downwards towards Gearbox Module.)
- Hold the Gearbox Module stationery and screw on the Motor Module, tighten to a minimum torque of 100lb.ft.
- Once the connection has been torqued it is recommended to perform a ‘Surface Test’ to ensure the tool is working correcting. Reference section *8 How to Surface Test the **K-Set*** for guidance.

14.2 Gearbox Module Removal/Re-fit

If the Gearbox Module to Linear Actuator Module connection becomes un-torqued then it is recommended to fully break out the connection and inspect the sealing arrangement. It is recommended that as a minimum the O-Rings are replaced.

The Gearbox Module utilizes a **left-hand thread** to eliminate the possibility of the tool un-torqueing during normal operation.

Removal

- While holding the Linear Actuator Housing stationary un-screw the Gearbox Module. **NOTE THIS IS A LEFT-HAND THREAD.** This will allow access to the Gearbox Module main body thread and sealing arrangement. Remove all O-rings and Back-Up rings using a non-metallic O-ring pick or similar, and clean all sealing surfaces. It is recommended that the O-Rings are discarded and replaced. The Back-Up rings should be inspected for damage and may be re used if they are deemed in an acceptable condition.
- Fit the O-rings and Back-Up rings to the Gearbox Module ensuring the correct orientation (i.e. O-ring to the pressure side of the connection, concave side of the Back-Up ring to the O-ring). Apply a light coat of grease to the O-rings and thread.

Re-fit

To ensure that the Gearbox Module makes up fully to the Linear Actuator Module the Ball Screw assembly must be in a neutral position (i.e. it cannot be in contact with the internal hard stop.) Therefore, before making up this connection the Slick Rod should be pushed into the Linear Actuator Module assembly by a minimum of 100mm. Once moved inward, the Gearbox Drive Coupling should be rotated clockwise for 5 full rotations.

- Secure the Linear Actuator Module and gently tap on the bottom flat face of the Slick Rod with a plastic hammer until the Gearbox Drive Coupling at the top of the Linear Actuator Module moves upwards in order to aid with the Gearbox Drive Coupling Alignment. This only needs to be moved upwards by approximately 100mm. Rotate the Gearbox Drive Coupling clockwise by 5 rotations, this will ensure that the connection can be made up fully without any interference from the Ball Screw assembly contacting the internal hard stop.

It is **IMPERATIVE** that the Slick Rod is not held/gripped or damaged. The Slick Rod is a dynamic sealing surface and any damage to this part **WILL** cause improper function of the tool

Figure 99 - Picture showing the Drive Coupling protruding from the Linear Actuator Module

- Offer up the Gearbox Module and engage the Gearbox Output Shaft with the Gearbox Drive Coupling.
- Push the Gearbox Module into the Linear Actuator Module and make up the thread. **NOTE THIS IS A LEFT-HAND THREAD.** The Housing should be made up to a minimum torque of 100lb.ft.
- Once the connection has been torqued it is recommended to perform a 'Surface Test' to ensure the tool is working correcting. Reference section *8 How to Surface Test the* ***K-Set*** for guidance.

14.3 Outer Adaptor Removal/Re-fit

If the Outer Adaptor and Linear Actuator connection becomes un-torqued then it is recommended to fully break out the connection and inspect the sealing arrangement. It is recommended that as a minimum the O-Rings, Wedge Seal and PTFE Rod Seal are replaced.

Removal

- While holding the Linear Actuator Module stationary un-screw the Outer Adaptor fully. This will allow access to the Outer Adaptor main body thread sealing arrangement. Slide the Outer Adaptor off the Slick Rod. Remove all O-rings and Back-Up rings from the external body thread using a non-metallic O-ring pick or similar, and clean all sealing surfaces. It is recommended that the O-Rings are discarded and replaced. The Back-Up rings should be inspected for damage and may be re used if they are deemed in an acceptable condition.
- Fit the O-rings and Back-Up rings to the Outer Adaptor ensuring the correct orientation (i.e. O-ring to the pressure side of the connection, concave side of the Back-Up ring to the O-ring). Apply a light coat of grease to the O-rings and thread.
- With a non-metallic O-ring Pick or similar, reach into the bore of the Outer Adaptor and remove the Wedge Seal and both angled Back-Up rings. It is recommended to change both the Wedge Seal and Back-Up rings at this point.

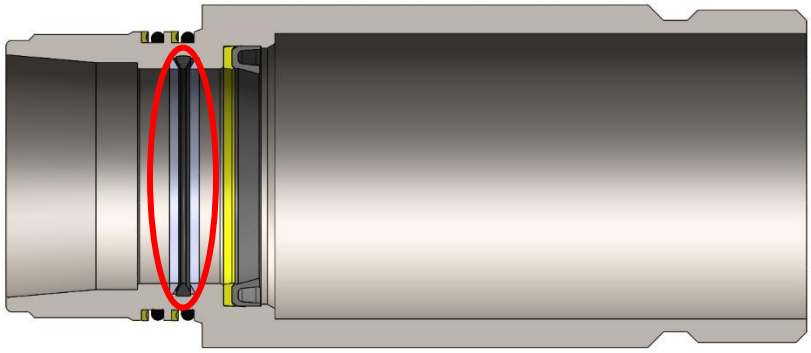


Figure 100 - Image of Wedge Seal and Back-Up rings location

- Using a long flat bladed screwdriver or similar, reach through the top threaded bore end of the Outer Adaptor and gently tap out the PTFE Rod Seal out of its seat, taking care not to damage the seal bore. Once the PTFE Rod Seal is removed, use a non-metallic O-ring pick to remove the Back-Up ring behind the PTFE Rod Seal if it does not come out with the PTFE Rod Seal. It is recommended to replace the PTFE Rod Seal and Back-Up ring at this point. Clean all internal seal bores and inspect for signs of damage. Lightly grease all internal seal bores ready for new seal installation.

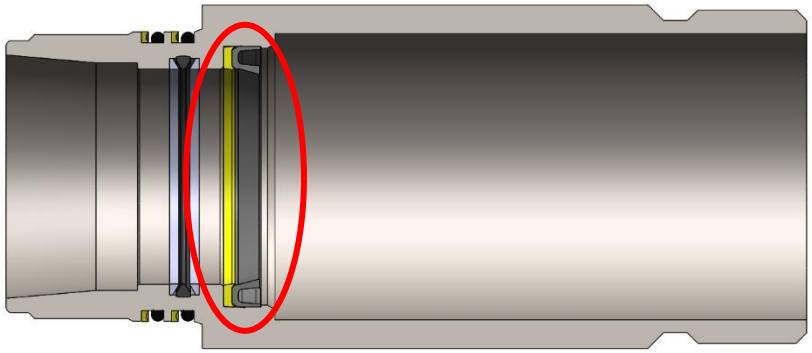


Figure 101 - Image of PTFE Rod Seal and Back-Up

- Ensure the Wedge Seal and corresponding Back-Ups are orientated correctly (Vee point of Wedge Seal facing into the Slick Rod and the Back-Ups should be angled into the shape of the Wedge seal). Fit one of the Back-Up rings into the recess, followed by the Wedge Seal then the final Back-Up ring.

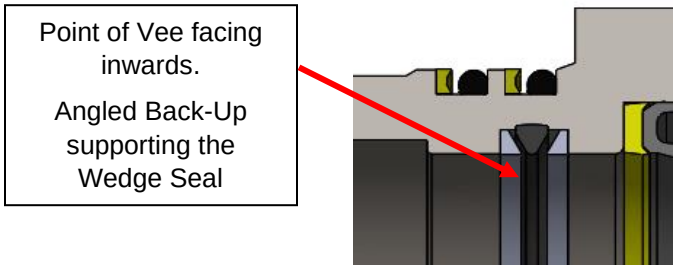


Figure 102 - Image showing Wedge Seal and Back-Up orientation

- Fit the PTFE Rod Seal Back-Up ring into the corresponding seal bore of the Outer Adaptor. With the PTFE Rod Seal Orientated correctly (Flat face pointing into the Outer Adaptor) fit the PTFE Rod Seal. It is important that this seal is fitted square and even into the Seal Bore. An installation tool (**kaseum** part number 001502) for fitting the PTFE Rod Seal can be purchased from **kaseum** on request.

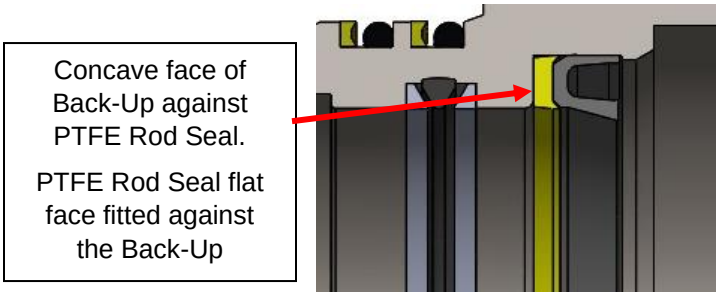


Figure 103 - Image showing PTFE Rod Seal and Back-Up orientation

Re-fit

- Carefully slide the Outer Adaptor over the Slick Rod and engage the main body thread into the Linear Actuator Module. Hold the Linear Actuator Module stationary and tighten the Outer Adaptor to a minimum torque of 100lb.ft
- Once the connection has been torqued it is recommended to perform a 'Surface Test' to ensure the tool is working correcting. Reference section *8 How to Surface Test the* ***K-Set*** for guidance.

15 Periodic and Routine Service Instructions

To keep the **K-Set** operating effectively it is imperative that routine and periodic servicing and maintenance is carried out. **kaseum** recommend the following servicing plan.

15.1 Field Service Schedule (every run)

The field user should carry out the following service procedure after each and every run in-hole:

- The PCM should be discarded/recycled and replaced.
- The O-Rings on the Motor Module and PCM Housing connection should be inspected. **kaseum** recommend that the O-rings are changed as a minimum:
    - After every run in-hole.
    - If any indication of damage is present.
    - Or, as per your company O-ring preventative maintenance procedure.
- The Back-Up rings should be inspected for damage. These Back-Up rings will be suitable for constant use until the first routine service interval (i.e. 25 run service), however if any damage is observed then they should be changed immediately.
- The O-rings in the Top Crossover (if supplied) should be replaced periodically also. **kaseum** recommend that these O-rings are changed as a minimum:
    - After 5 runs in hole (if the connection is unbroken, otherwise every run).
    - If exposed to temperatures exceeding 80°C.
    - If exposed to pressure greater than 5000psi.
    - If broken out of the PCM Housing then they should be changed.
    - As per company O-ring preventative maintenance procedure.
- Any tooling marks/burrs/rough edges should be dressed off/removed.
- The Outer Adaptor thread and Slick Rod thread should be inspected and any damage should be removed.

15.2 Routine Service Schedule (after 25,50 and 100 runs)

There are three significant service intervals throughout the operational life of the **K-Set**. After 25, 50 (or 2 years) and 100 runs it is recommended that the **K-Set** is taken out of active service and the following schedule should be undertaken:

The outlined service schedule should be used as a minimum guideline. If company procedure/policy dictate that that a more frequent or stringent schedule is carried out then this will supersede **kaseum** recommendations

15.2.1 After Every 25 Runs

After 25 runs in hole the Motor Module should be replaced. To replace the Motor Module:

Disassembly

- Whilst holding the Motor Module stationary un-screw the PCM Housing from the Motor Module.
- Whilst holding the Gearbox Module stationary, unscrew the Motor Module from the Gearbox Module
- The Motor Module should be discarded appropriately.

Assembly

- Ensure the correct orientation of the new Motor Module. The Spring-loaded Motor Coupling should be fitted downwards towards to the Gearbox Module and the Electrical 4 pin Cap should be facing upwards.
- Grease the O-rings and thread on the Gearbox side of the new Motor Module. It is beneficial to apply a small amount of grease to the internal bore of the Coupling on the Motor Module and the Input Shaft of the Gearbox Module.
- Whilst holding the Gearbox Module stationary, make up the Motor Module to the Gearbox Module to a minimum torque of 100lb.ft.
- Perform a 'Surface Test' to ensure that the **K-Set** is functioning correctly. Reference section *8 How to Surface Test the **K-Set*** of this manual for guidance. This completes the 25-run service schedule

15.2.2 After Every 50 Runs or 2 years

After 50 runs or every 2 years the **K-Set** should have all elastomeric seals and Back-Up rings replaced, as well as the schedule outlined above in the 25-run service schedule:

Disassembly

- Whilst holding the Motor Module stationary un-screw the PCM Housing from the Motor Module.
- Whilst holding the Gearbox Module securely, un-screw the Motor Module and remove.
- Whilst Holding the Linear Actuator Housing securely, un-screw the Gearbox Module and remove.

NOTE THIS IS A LEFT-HAND THREAD.

- Whilst Holding the Linear Actuator Housing securely, unscrew the Outer Adaptor and remove.

Now all elastomeric O-rings will be visible. There are 4 sets of seals that need to be replaced:

  - 1 set on the Gearbox Module (a pair of O-ring seals and Back-Up rings on the Gearbox Housing main body thread),
  - 3 sets on the Outer Adaptor (a pair of O-Ring seals on the Outer Adaptor main body thread, and a Wedge Seal and Back-Up arrangement along with the PTFE Rod Seal and Back-Up in the internal bore).

- With a non-metallic O-ring Pick or similar, remove the O-rings and Back-Up rings from the Gearbox Housing main body thread.

Figure 104 - image showing Gearbox Housing O-ring and Back-Up location

- With a non-metallic O-ring Pick or similar, remove the O-rings and Back-Up rings from the Outer Adaptor main body thread.

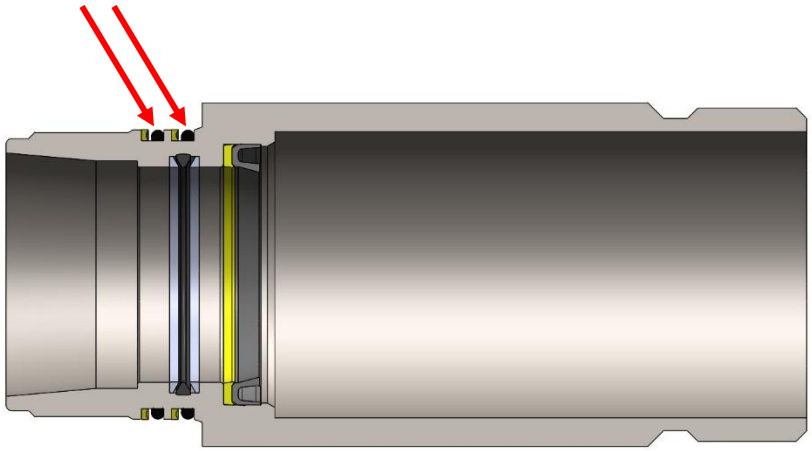


Figure 105 - Image showing Outer Adaptor main body O-rings and Back-Ups

- With a non-metallic O-ring Pick or similar, reach into the bore of the Outer Adaptor and remove the Wedge Seal and both angled Back-Up rings.

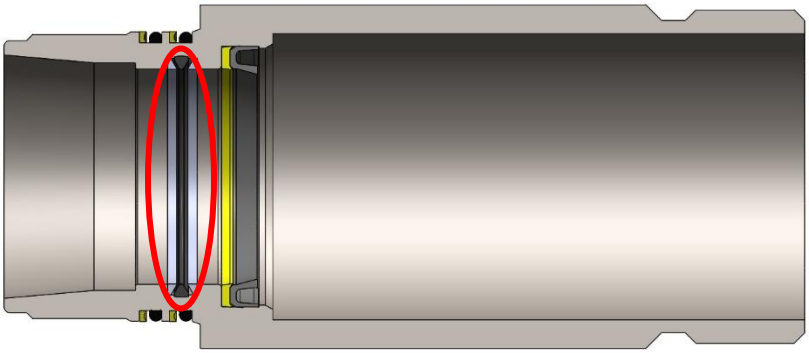


Figure 106 - Image of Wedge Seal and Back-Up rings location

- Using a long flat bladed screwdriver or similar, reach through the top threaded bore end of the Outer Adaptor and gently tap out the PTFE Rod Seal out of its seat, taking care not to damage the seal bore. Once the PTFE Rod Seal is removed, use a non-metallic O-ring pick to remove the Back-Up ring behind the PTFE Rod Seal if it does not come out with the PTFE Rod Seal.

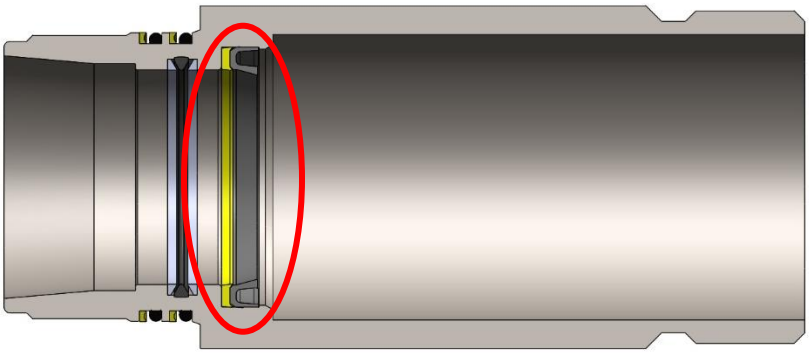


Figure 107 - image of PTFE Rod Seal and Back-Up

With the O-rings, Wedge Seal, PTFE Rod Seal and all Back-Up rings removed, clean all the seal bores and inspect for signs of damage. Lightly grease all seal bores ready for installation.

Assembly

- Fit the new O-rings and Back-Up rings to the Gearbox Module main body thread. Ensure that the O-ring is positioned correctly (the O-ring should be at the pressure side of the connection) and the Back-Up ring is orientated correctly (concave face against the O-ring).
- Ensure the Wedge Seal and corresponding Back-Ups are orientated correctly (Vee point of Wedge Seal facing into the Slick Rod and the Back-Ups should be angled into the shape of the Wedge seal). Fit one of the Back-Up rings into the recess, followed by the Wedge Seal then the final Back-Up ring.

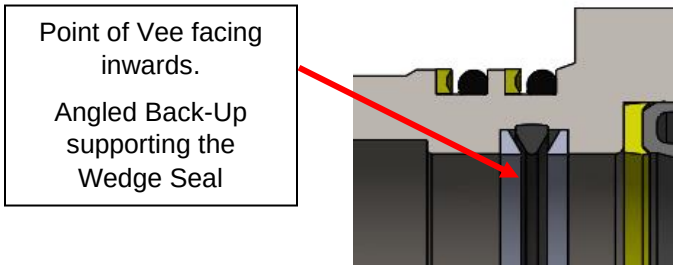


Figure 108 - Image showing Wedge Seal and Back-Up orientation

- Fit the PTFE Rod Seal Back-Up ring into the corresponding seal bore of the Outer Adaptor. With the PTFE Rod Seal Orientated correctly (Flat face pointing into the Outer Adaptor) fit the PTFE Rod Seal. It is important that this seal is fitted square and even into the Seal Bore. An installation tool (**kaseum** part number 001502) for fitting the PTFE Rod Seal can be purchased from **kaseum** on request.

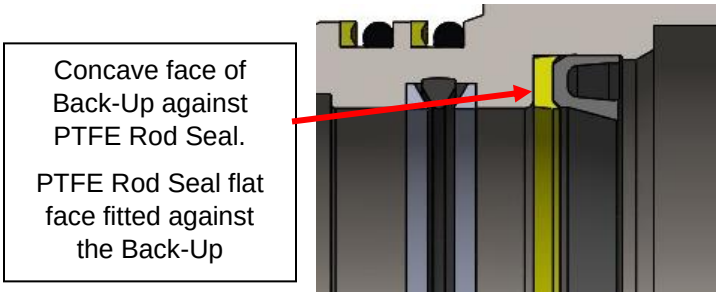


Figure 109 - Image showing PTFE Rod Seal and Back-Up orientation

- Whilst Holding the Linear Actuator Housing securely, Make-up the Outer Adaptor to a minimum torque of 100lb.ft
- Whilst Holding the Linear Actuator Housing securely, Make-up the Gearbox Module to a minimum torque of 100lb.ft. Ensure that the Gearbox coupling is aligned before making up the thread.

NOTE THIS IS A LEFT-HAND THREAD.

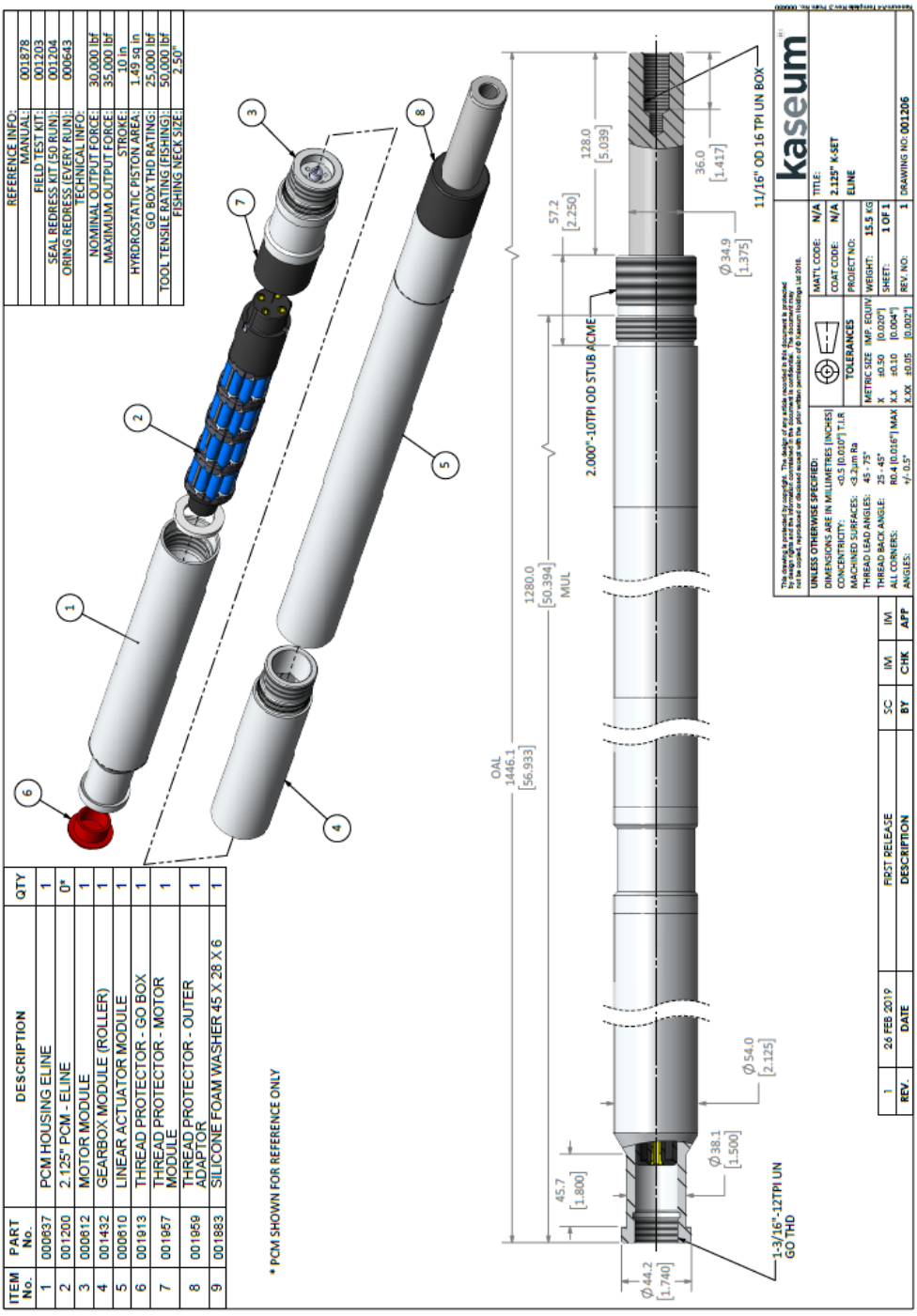
- Whilst holding the Gearbox Module securely, Make up the new Motor Module to a torque of at least 100lb.ft
- Perform a 'Surface Test' to ensure that the **K-Set** is functioning correctly. Reference section *8 How to Surface Test the **K-Set*** of this manual for guidance. This completes the 50-run service schedule

15.2.3 After Every 100 Runs

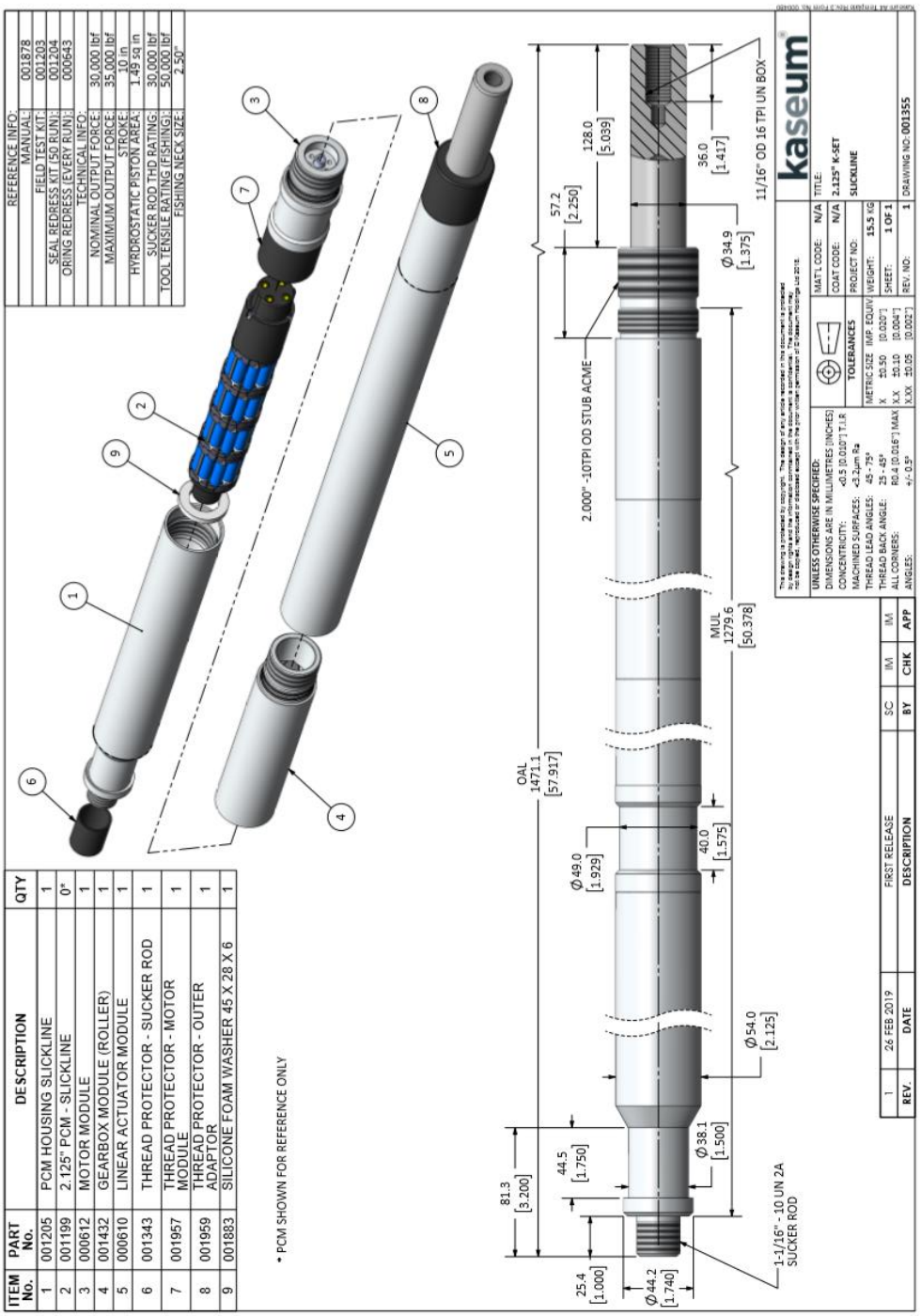
100 runs signify a milestone in the **K-Set** operational life cycle and it is recommended to fully replace and inspect all critical parts. Over and above all the actions mentioned in the previous 2 service schedules (25 and 50 run) it is recommended to fully strip down and inspect the Gearbox Module and Linear Actuator Module. This is to be undertaken by **kaseum** or **kaseum** trained personnel **ONLY**.

16 REFERENCE DRAWINGS

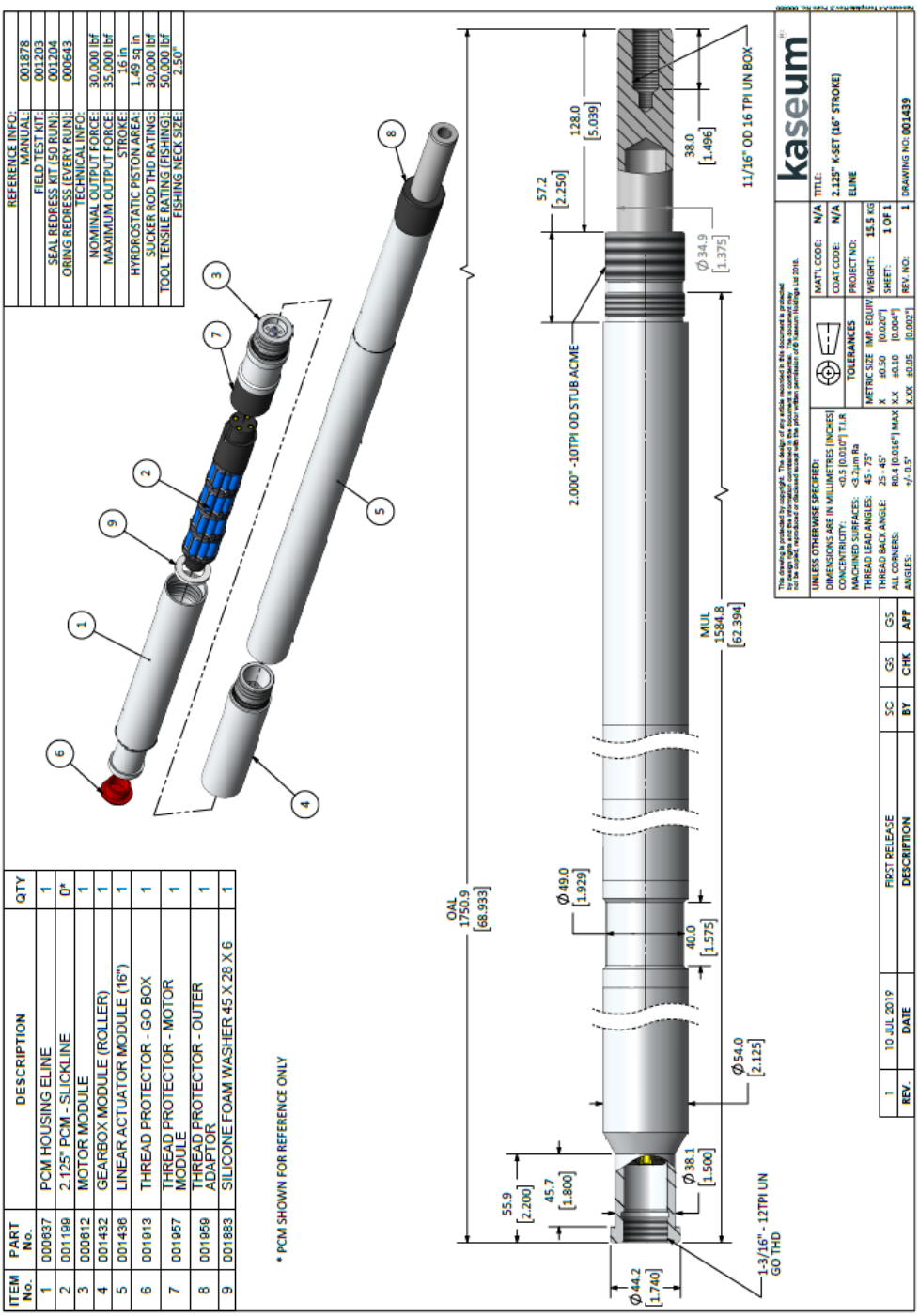
16.1 Assembly Drawing E-Line 001206 Standard Length



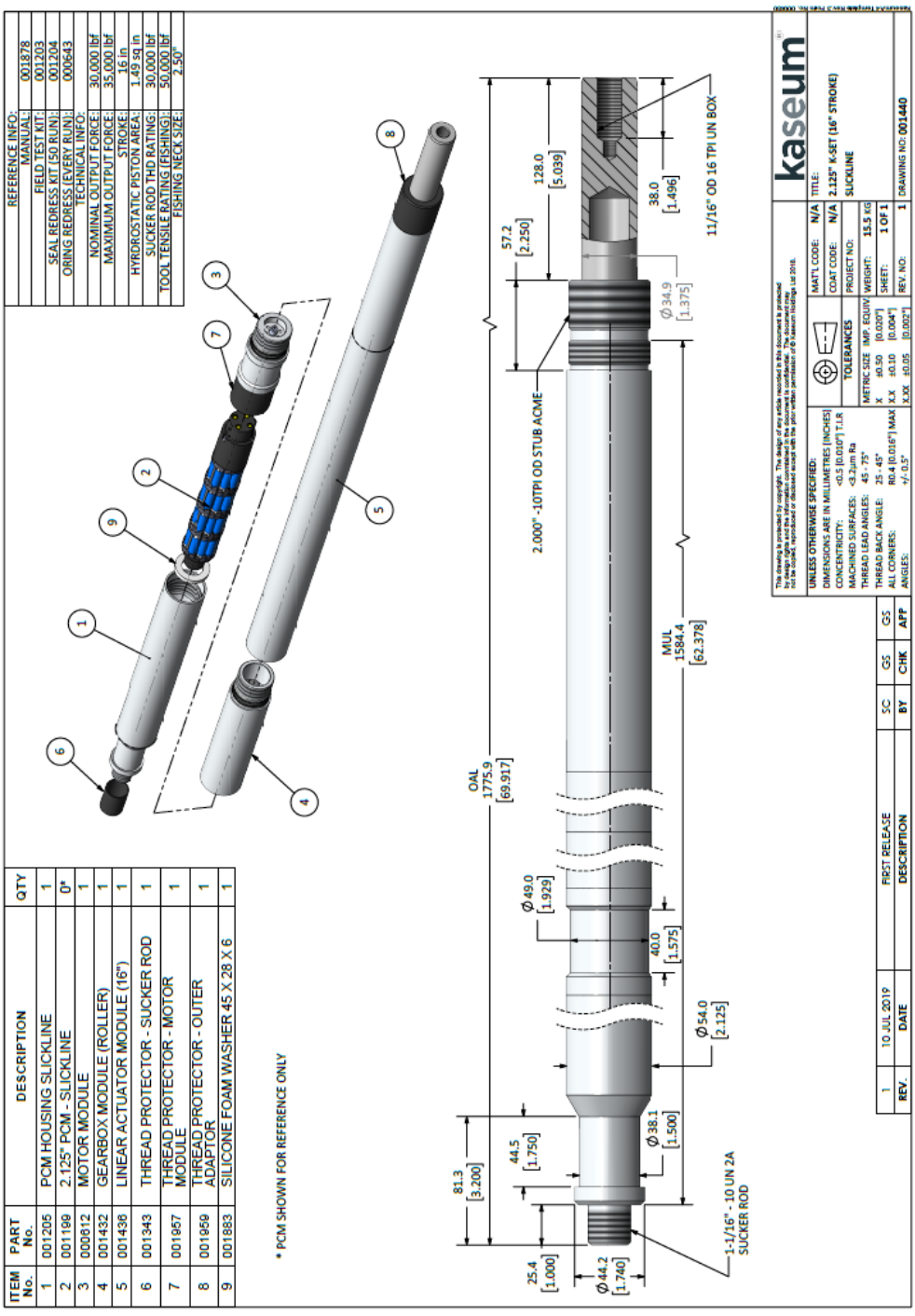
16.2 Assembly Drawing Slickline 001355 Standard Length



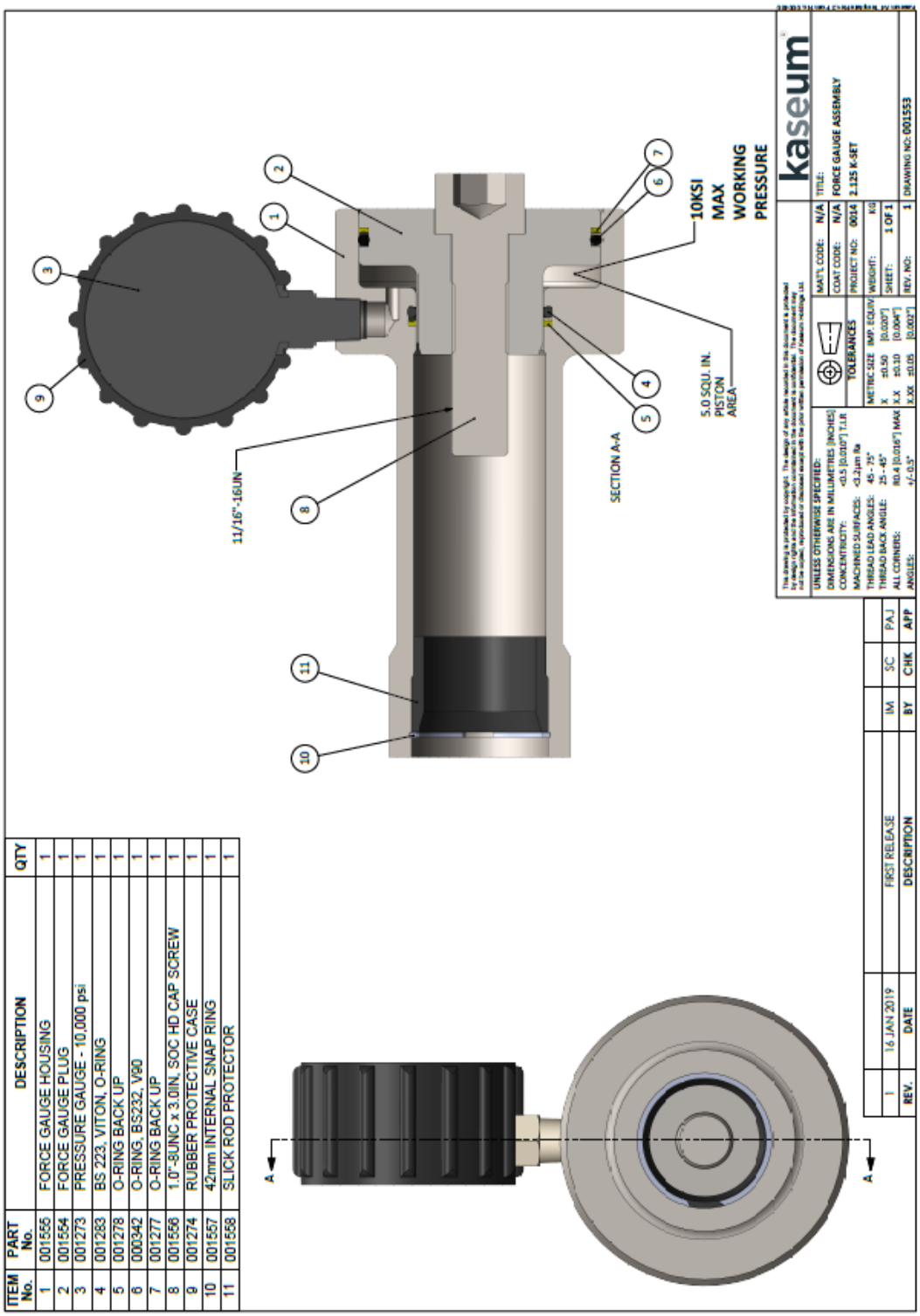
16.3 Assembly Drawing E-Line 001439 Extended Length



16.4 Assembly Drawing Slickline 001440 Extended Length



16.5 Force Gauge Assembly Drawing 001553



ITEM No.	PART No.	DESCRIPTION	QTY
1	001555	FORCE GAUGE HOUSING	1
2	001564	FORCE GAUGE PLUG	1
3	001273	PRESSURE GAUGE - 10,000 psi	1
4	001283	BS 223, VITON, O-RING	1
5	001278	O-RING BACK UP	1
6	000342	O-RING, BS232, V90	1
7	001277	O-RING BACK UP	1
8	001556	1.0"-8UNC x 3.0IN, SOC HD CAP SCREW	1
9	001274	RUBBER PROTECTIVE CASE	1
10	001557	42mm INTERNAL SNAP RING	1
11	001558	SLICK ROD PROTECTOR	1

17 APPENDIX A- Definitions, Acronyms, and Abbreviations

Define all terms, acronyms, and abbreviations used in this document.

K-Set	**kaseum** Setting Tool Product Line
PCM	Power and Comms Module
Surface Interface	Surface Read Out Interface Box Assembly

References

kaseum Part Number	**Description**
001355	**K-Set** Assembly Slickline Standard Length
001206	**K-Set** Assembly E-Line Standard Length
001440	**K-Set** Assembly Slickline Extended Length
001439	**K-Set** Assembly E-Line Extended Length
001553	Force Gauge Assembly
001229	**K-Log** Software Application
000952	Surface Interface Box Assembly
001199	Memory Mode PCM
001200	SRO Mode PCM
001223	USB Interface Cable
001502	2.125” Plastic Seal Assy Tool
001205	PCM Housing Slickline
000637	PCM Housing E-Line

18 APPENDIX B- Battery MSDS

MSDS:

VARTA CONSUMER BATTERIES

Safety Data Sheet

Alkaline-Batteries

Edition: 2019-04-08 / Version: 17

1. IDENTIFICATION

Alkaline-Batteries **Sizes all**

VARTA Consumer Batteries
GmbH & Co. KGaA
Alfred-Krupp-Str. 9 73479 Ellwangen/Germany
Phone ++49 (0) 7961 / 83-0
Fax ++49 (0) 800 / 8278274

Emergency Telephone Number: ++49 (0) 911 / 65372260

2. HAZARDS IDENTIFICATION

Note: The batteries described in this Safety Data Sheet are sealed and are not harmful, as long as they are used in compliance with the manufacturer instructions. The content of the battery housing does not create a hazard, as long as the integrity of the battery housing is not affected by abuse (mechanicel, thermal, electrical). Fire, explosion and severe, burn hazard in such abuse conditions may occur.

Warning: Do not charge, short circuit, puncture, deform, disassemble, heat above 85 °C, incinerate or expose contents to water. Keep batteries away from small children. International Standard IEC 60086-5 contains more detailed information on safety of alkaline batteries.

GHS Classification: N/A

3. COMPOSITION / INFORMATION on INGREDIENTS

Substance	Approximate percent of total weight
Manganese Dioxide (MnO_2)	24 - 43
Zinc (Zn)	9 - 18
Graphite (C)	2 - 5
Potassium Hydroxide (KOH)	3 - 8
Steel	14 - 26
Zinc Oxide (ZnO)	< 0.5
Water, paper, plastic (Polyamide, Teflon), other	balance
Mercury (Hg)	0.00003
Lead (Pb)	0.0001 – 0.003
Cadmium (Cd)	0.00002

Alkaline-Batteries Page 1 / 4

4. FIRST AID MEASURES

Contact to internal Battery content:

- **Skin:** Immediately flush with plenty of water for at least 15 minutes. If symptoms are present after flushing, get medical attention.
- **Eyes:** Immediately flush with plenty of water for at least 15 minutes and get medical attention.
- **Respiratory system:** Leave area immediately. With large quantities and irritation of the respiratory tract get medical attention.
- **Ingestion:** Rinse mouth and sorrounding area with water. Seek for immediate medical attention.

5. FIRE – FIGHTING MEASURES

A. Extinguishing Media:

- Copious amounts of water is an effective extinguishing medium for alkaline batteries.
- Dry chemical type extinguishers may also be used.

B. Fire Fighting Procedures:

- Use a positive pressure self-contained breathing apparatus if batteries are involved in a fire.

6. ACCIDENTAL RELEASE MEASURES

When the battery housing is damaged, small amounts of electrolyte may leak. Seal battery air tight in a plastic bag, adding some dry sand, chalk ($CaCO_3$) or lime (CaO) powder or Vermiculite. Electrolyte traces may be wiped off dryly using household paper. Rinse with water afterwards.

7. HANDLING AND STORAGE

- Do not allow terminals to short-circuit.
- Storage preferably in a cool (below 30 ºC), dry area that is subject to little temperature change.
- Do not place near heating equipment, nor expose to direct sunlight for long periods. Elevated temperatures can result in reduced battery service life.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Respiratory eqipment:	None required under normal use conditions.
Hand protection:	None required under normal use conditions. Use butyl gloves when handling leaking batteries.
Eye protection:	None required under normal use conditions. Wear safety glasses when handling leaking batteries.

9. PHYSICAL AND CHEMICAL PROPERTIES

Geometric solid objects.

10. STABILITY AND REACTIVITY

May rupture violently when heated above 100 ºC or when charged.

11. TOXIOLOGICAL INFORMATION

Not applicable.

VARTA CONSUMER BATTERIES

Safety Data Sheet

Alkaline-Batteries

Edition: 2019-04-08 / Version: 17

12. ECOLOGICAL INFORMATION

Not applicable.

13. DISPOSAL CONSIDERATIONS

In accordance with appropriate national regulations (2006/66/EC).

14. TRANSPORT INFORMATION

Alkaline batteries, which we supply to our customers are not subject to dangerous goods transport regulations due to following regulations:

Air transport: IATA **Dangerous Goods Regulations** 60th Edition special provision A123
The shipping documents contain "Not restricted, as per Special Provision A123"in the airwaybill (8.2.6 IATA-DGR)
Sea transport: IMDG Code 39. Amendment
Road and rail transport: ADR/RID 2019

All of these batteries are carefully packed and provide appropriate protection for prevention of short circuits.

15. REGULATORY INFORMATION

Not applicable.

16. OTHER INFORMATION

For alkaline batteries in general, Safety standard IEC 60086-5 applies.
It contains detailed recommendations for manufactures of equipment and users.

Alkaline-Batteries Page 4 / 4