SC50 Autonomous System Error Codes

Autonomy Firmware Revision: 9.4.3

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Nilfisk®

Autonomous System Error Codes

Firmware 9.4.3 Autonomous

5-3000 Low Battery Voltage

Description	Battery voltage below the minimum threshold
Fault Name	VOLT_PLAT_INFO_BAT_MIN
Setting Conditions	Platform Board measures battery voltage of 33V or more. hould be 24V.
When Monitored	Always Monitored
Possible Causes	The most likely cause is an internal error in the autonomous module.
Initial Action	None

Troubleshooting Steps

1. Measure the battery voltage at the batteries.
    - If the battery voltage is out of range, diagnose the battery charger.
2. Measure the voltage between contacts J6-22 and J6-23 at the autonomous module.
    - If the voltage is normal, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-3001 High Battery Volt

Description	Battery voltage above the maximum threshold
Fault Name	VOLT_PLAT_INFO_BAT_MAX
Setting Conditions	Platform Board measures battery voltage of 19V or less. Should be 24V.
When Monitored	Always Monitored
Possible Causes	The most likely cause is a poor connection in the power wiring to the module, causing an excessive voltage drop.
Initial Action	Make sure batteries are charged

Troubleshooting Steps

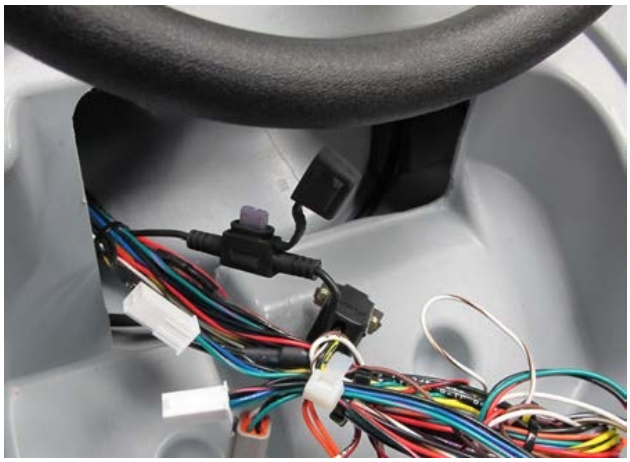
Identify the source of voltage drop between the main batteries and the autonomous system by checking voltages along the circuit path.

1. Record the voltage directly at the battery terminals. Use this as the baseline for all subsequent measurements.
2. Check the voltage between contacts J6-23 and J6-22.
    - If the voltage is at or near battery voltage, inspect the connection, otherwise, contact Nilfisk Technical Support for authorization to replace the autonomous module.
    - If the voltage is low, continue to step 3.
3. Isolate the cause between battery positive and battery negative circuits
    a. Check the voltage between contact J6-23 and the negative battery terminal.
        - If the voltage is low, troubleshoot the positive circuit. See step 4.

    b. Check the voltage between contact J6-22 and the positive battery terminal.
        - If the voltage is low, troubleshoot the negative battery circuit. See step 4.
4. Positive circuit checks. Reference all voltages directly to the battery negative post.
    a. Check the voltage at the downstream terminal of the 3-amp fuse, located under the main control board.
        - If the voltage is high, repair or replace the wire between the fuse holder and the J6 connector.

    b. Check the voltage at the upstream terminal of the 3-amp fuse.
        - If the voltage is high, pull the fuse and clean the contacts of the fuse and fuse holder.

    c. Check the voltage at the battery-side of the K2 relay coil (which is used as a splice point for power connections).
        - If the voltage is high, repair or replace the wire between the K2 relay and the 3-amp fuse.
        - If the voltage is low, repair, replace, or tighten the connection between K1 and K2 relays.
5. Negative circuit checks. Reference all voltages directly to the battery positive post.
    a. Check the voltage at the negative binding post in the electrical bay.
        - If the voltage is high, repair or replace the wire between the binding post and the J6 connector.
        - If the voltage is low, repair or replace the main battery negative wire.



5-3010 Low 1.8V Voltage

Description	1.8V voltage below the minimum threshold
Fault Name	VOLT_PLAT_INFO_V1V8_MIN
Setting Conditions	Battery voltage on the 1.8 Volt line is belowe 1.65.
When Monitored	Always
Possible Causes	Battery issues
Initial Action	Check battery

5-3011 High 1.8V Voltage

Description	1.8V voltage above the minimum threshold
Fault Name	VOLT_PLAT_INFO_V1V8_MAX
Setting Conditions	Voltage on the 1.8 line is above 1.95 Volts.
When Monitored	Always
Possible Causes	Battery issues
Initial Action	Check battery

5-3020 Low 3.3V Voltage

Description	3.3V voltage below the minimum threshold
Fault Name	VOLT_PLAT_INFO_V3V3_MIN
Setting Conditions	Input 3.3 Voltage line is below 2.9 Volts.
When Monitored	Always
Possible Causes	Battery Issues
Initial Action	Check Battery

5-3021 High 3.3V Voltage

Description	3.3V voltage above the maximum threshold
Fault Name	VOLT_PLAT_INFO_V3V3_MAX

Setting Conditions	3.3 input Voltage is above 3.6 Volts.
When Monitored	Always
Possible Causes	Battery issues
Initial Action	Check Battery

5-3030 Low 5.0V Voltage

Description	5.0V voltage below the minimum threshold
Fault Name	VOLT_PLAT_INFO_V5V0_MIN
Setting Conditions	Input 5.0 Voltage line is below 4.5 Volts.
When Monitored	Always
Possible Causes	Battery issue
Initial Action	Check battery

5-3031 High 5.0V Voltage

Description	5.0V voltage above the maximum threshold
Fault Name	VOLT_PLAT_INFO_V5V0_MAX
Setting Conditions	Platform board detected the 5 Voltage input exceeded 5.7 volts.
When Monitored	Auto Mode
Possible Causes	Battery issues
Initial Action	Check battery

5-4060 Low Temperature

Description	Temperature below -10 degrees C
Fault Name	TEMP_PLAT_INFO_TEMP_MIN
Setting Conditions	Platform Board measures a temperature of -10 °C (14 °F) or less
When Monitored	Always
Possible Causes	
Initial Action	If the machine was stored in a below-freezing environment, make sure sufficient time is given to warm all internal components. Open hoods and covers as necessary. (Also inspect all fluid systems for freezing damage.)

Troubleshooting Steps

If the error condition persists when the machine is warm, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-4061 High Temperature

Description	Temperature above 80 degrees C
Fault Name	TEMP_PLAT_INFO_TEMP_MAX
Setting Conditions	Platform Board measures a temperature of 80 °C (178 °F) or more
When Monitored	Always
Possible Causes	Environment too hot. Blocked cooling. Module failure.
Initial Action	Allow machine to cool down.

Troubleshooting Steps

1. Confirm the condition.
    a. Using an appropriate thermometer, check the temperature of the autonomous module heatsink.
        - If the temperature is significantly below 80 °C and the error condition persists, contact Nilfisk Technical Support for authorization to replace the autonomous module.

    b. Shut down the machine and allow it to cool.
    c. Restart the machine and operate it in autonomous mode.
        - If the error condition persists, isolate the cause.

2. Clean heat sinks and air vents.
    a. Remove the autonomous cover and clean the air vent and check for obstructions.
    b. Vacuum off dust and debris from all electronic components and their heatsinks.
    c. Make sure the autonomous module is securely fastened to the metal platform.
3. Minimize environmental factors.
    a. Avoid operating the machine in unusually hot environments.
    b. Avoid operating the machine where direct sunlight can adversely heat the autonomous bay.
        - If the error persists after all variables have been addressed, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-E403 Obstructed Prox

Description	Proximity Sensors are obstructed
Fault Name	KNIGHTEX_COMP_INFO_AUTOSAFETY2_OBSTRUCTEDPROXLASERS
Setting Conditions	Vehicle wasn't able to enter auto because the 2D Safety LIDARs are tripped.
When Monitored	Entering Auto Mode
Possible Causes	Obstacle in the way. Dirty 2D Safety LIDARs. Malfunctioning or damaged 2D LIDARs.
Initial Action	Check error codes on 2D Safety LIDARs.

Troubleshooting Steps

Refer to the Hokuyo UAM manual to troubleshoot safety codes on the 2D LIDAR.

5-E404 Dirty/Scratched Dropoff

Description	Dropoff Sensor is dirty or scratched
Fault Name	KNIGHTEX_COMP_INFO_AUTOSAFETY2_OBSTRUCTEDDROPOFFS
Setting Conditions	The drop-off sensor is reporting a general error not specific to a single drop-off sensor

When Monitored	When entering Auto mode
Possible Causes	Electrical Issue or more than one drop-off sensor is tripping at the same time.
Initial Action	Remove things blocking the sensors or move vehicle away from the ledge

5-E405 Obstructed Front Left Dropoff

Description	Dropoff Sensor is dirty or scratched
Fault Name	KNIGHTEX_COMP_INFO_AUTOSAFETY2_OBSTRUCTEDFRONTLEFTDROPOFF
Setting Conditions	The front left drop-off sensor is reporting that it is unsafe
When Monitored	When entering Auto mode
Possible Causes	Drop-off sensor scratched. Something is in the way or vehicle is starting near a ledge.
Initial Action	Remove what is blocking the sensor or move away from the ledge

5-E406 Obstructed Front Right Dropoff

Description	Dropoff Sensor is dirty or scratched
Fault Name	KNIGHTEX_COMP_INFO_AUTOSAFETY2_OBSTRUCTEDFRONTRIGHTDROPOFF
Setting Conditions	The front right drop-off sensor is reporting that it is unsafe
When Monitored	When entering Auto mode
Possible Causes	Drop-off sensor scratched. Something is in the way or vehicle is starting near a ledge.
Initial Action	Remove what is blocking the sensor or move away from the ledge

5-E407 Obstructed Left Side Dropoff

Description	Dropoff Sensor is dirty or scratched
Fault Name	KNIGHTEX_COMP_INFO_AUTOSAFETY2_OBSTRUCTEDLEFTDROPOFF
Setting Conditions	The side left drop-off sensor is reporting that it is unsafe
When Monitored	When entering Auto mode
Possible Causes	Drop-off sensor scratched. Something is in the way or vehicle is starting near a ledge.
Initial Action	Remove what is blocking the sensor or move away from the ledge

5-E408 Obstructed Right Side Dropoff

Description	Dropoff Sensor is dirty or scratched
Fault Name	KNIGHTEX_COMP_INFO_AUTOSAFETY2_OBSTRUCTEDRIGHTDROPOFF
Setting Conditions	The right side drop-off sensor is reporting that it is unsafe
When Monitored	When entering Auto mode
Possible Causes	Drop-off sensor scratched. Something is in the way or vehicle is starting near a ledge.
Initial Action	Remove what is blocking the sensor or move away from the ledge

5-E409 Obstructed Left Prox

Description	Left Proximity Sensor is dirty or scratched

Fault Name	KNIGHTEX_COMP_INFO_AUTOSAFETY2_OBSTRUCTEDLEFTPROXLASER
Setting Conditions	The front left proximity LIDAR is reporting that it is unsafe
When Monitored	When entering Auto mode
Possible Causes	Proximity LIDAR sensor scratched or dirty. Something is in the way of the vehicle.
Initial Action	Clean the sensor with a lens wipe. Remove what is blocking the sensor. Move away from the Object.

5-E40A Obstructed Right Prox

Description	Right Proximity Sensor is dirty or scratched
Fault Name	KNIGHTEX_COMP_INFO_AUTOSAFETY2_OBSTRUCTEDRIGHTPROXLASER
Setting Conditions	The front right proximity LIDAR is reporting that it is unsafe
When Monitored	When entering Auto mode
Possible Causes	Proximity LIDAR sensor scratched or dirty. Something is in the way of the vehicle.
Initial Action	Clean the sensor with a lens wipe. Remove what is blocking the sensor. Move away from the Object.

5-E410 Exit Power Button

Description	Operator exited autoscrub by pressing power button
Fault Name	KNIGHTEX_COMP_INFO_AUTO3_POWERBUTTON
Setting Conditions	The Main Module Controller initiated power down by toggling the KSI line
When Monitored	Always Mode
Possible Causes	Operator exited autoscrub by pressing power button. Machine had a fatal fault and shut down.
Initial Action	None

Troubleshooting Steps

If the shutdown was unintentional, check the KSI circuit to the autonomous module for open circuit and check other fault codes for errors.

5-E414 Not in Start Area

Description	Unable to enter Auto-scrub, not in the start area
Fault Name	KNIGHTEX_COMP_INFO_AUTO3_NOTINSTARTAREA
Setting Conditions	The operator attempted to start autonomous operation outside of the start area
When Monitored	When entering Auto mode
Possible Causes	Either the whole vehicle or part of the vehicle is outside of the start area.
Initial Action	Drive scrubber to start area.

5-E415 Busy No Auto

Description	Unable to enter Auto-scrub, scrubber is busy

Fault Name	KNIGHTEX_COMP_INFO_AUTO3_BUSY
Setting Conditions	The operator attempted to begin “playback” of a plan when the scrubber was busy doing something else.
When Monitored	Entering Auto Mode
Possible Causes	Operator tried to autoscrub before the plan finished saving.
Initial Action	Let the operator finish its operation such as processing a training plan, then reattempt.

5-E419 Can't Find Path

Description	Auto-scrub unable to continue. Can't find path to continue.
Fault Name	KNIGHTEX_COMP_INFO_AUTO3_NOPATHLASER
Setting Conditions	Scrubber isn't able to navigate around obstacle detected by the 2D Mapping LIDAR.
When Monitored	Auto Mode
Possible Causes	Obstacle in the way. Dirty 2D Mapping LIDAR.
Initial Action	Move obstacle. Clean LIDAR.

5-E41A Can't Find Path

Description	Auto-scrub unable to continue. Can't find path to continue.
Fault Name	KNIGHTEX_COMP_INFO_AUTO3_NOPATHCAMERA
Setting Conditions	The scrubber can't navigate around obstacles detected by the 3D Camera.
When Monitored	Auto Mode
Possible Causes	Obstacle in the way of the scrubber. Dirty Camera. Camera that is poorly calibrated.
Initial Action	Move obstacle. Clean camera. Calibrate camera.

5-E41B Can't Find Path

Description	Auto-scrub unable to continue. Can't find path to continue.
Fault Name	KNIGHTEX_COMP_INFO_AUTO3_NOPATHOTHER
Setting Conditions	The scrubber is unable to find a path around the obstacles detected from multiple devices.
When Monitored	Auto Mode
Possible Causes	Obstacles in the way, or one of the sensors is dirty.
Initial Action	Clean sensor or move obstacle.

5-E41C Can't Find Path

Description	Auto-scrub unable to continue. Can't find path to continue.
Fault Name	KNIGHTEX_COMP_INFO_AUTO3_NOPATHPROXIMITY
Setting Conditions	The scrubber is unable to navigate around obstacles detected by the the Safety LIDARs.
When Monitored	Auto Mode
Possible Causes	Obstacle in the way or dirty Safety LIDARs.
Initial Action	Move obstacles or clean Safety LIDAR

5-E449 Optical Window Dirty

Description	Hokuyo Secondary Laser Error B1-C0: Optical Window Contaminated
Fault Name	KNIGHTEX_COMP_INFO_HOKSECONDARYMONITOR_OPTICALWINDOWCONTAMINATED
Setting Conditions	Right Proximity LIDAR reports error code B1-C0: Optical Window (Lens) Contaminated.
When Monitored	Always
Possible Causes	Laser window (lens) obscured or dirty
Initial Action	Clean LIDAR Window

Troubleshooting Steps

1. Clean laser window (lens).
2. Replace Safety Sensor lens. See instruction sheet IS56090416

5-E520 Motor Error

Description	Hokuyo Secondary Laser Error 60-63: laser motor error
Fault Name	KNIGHTEX_COMP_WARN_HOKSECONDARYHARDWARE_MOTORERROR
Setting Conditions	Error reported by the Proximity LIDAR
When Monitored	Always
Possible Causes	
Initial Action	

Troubleshooting Steps

This is an error forwarded from the Proximity LIDAR. Consult the Hokuyo UAM manual for further troubleshooting steps.

5-E540 Invalid Area Name

Description	Hokuyo Secondary Laser Error 56: Invalid Area Scan
Fault Name	KNIGHTEX_COMP_WARN_HOKSECONDARYMONITOR_INVALIDAREAERROR
Setting Conditions	Input status error during area switching for the Proximity LIDAR
When Monitored	Always
Possible Causes	Area Address Wiring Failure, Sensor Failure
Initial Action	

Troubleshooting Steps

Check the area address voltages on J11-3 through J11-12. Make sure each address line and its compliment are opposite one another. (See “Sample Shop Voltage Measurements”)

5-E541 Input Connection Error

Description	Hokuyo Secondary Laser Error 57: Area input connection errorr
Fault Name	KNIGHTEX_COMP_WARN_HOKSECONDARYMONITOR_INPUTCONNECTIONERROR
Setting Conditions	IInput status error during area switching
When Monitored	Always

Possible Causes	Area Address Wiring Failure, Sensor Failure
Initial Action	

Troubleshooting Steps

Check the area address voltages on J11-3 through J11-12. Make sure each address line and its compliment are opposite one another. (See “Sample Shop Voltage Measurements”)

5-E543 Invalid Area Error

Description	Hokuyo Secondary Laser Error 5E: Invalid Area Error
Fault Name	KNIGHTEX_COMP_WARN_HOKSECONDARYMONITOR_INVALIDAREADERROR
Setting Conditions	Input status error during area switching for the Proximity LIDAR
When Monitored	Always
Possible Causes	Area Address Wiring Failure, Sensor Failure
Initial Action	

Troubleshooting Steps

Check the area address voltages on J11-3 through J11-12. Make sure each address line and its compliment are opposite one another. (See “Sample Shop Voltage Measurements”)

5-E544 Optical Interference

Description	Hokuyo Secondary Laser Error 70: Optical Interference High Mount Reflective Background
Fault Name	KNIGHTEX_COMP_WARN_HOKSECONDARYMONITOR_OPTICALINTERFERENCEERROR
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	Light Interference from another LIDAR sensor. Highly reflective surface causing interference.
Initial Action	

Troubleshooting Steps

Check for sources of light interference from reflective surfaces or other LIDAR sources. Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E545 Communication Fault

Description	Hokuyo Secondary Laser Error 80: Lost Communication with Master Unit
Fault Name	KNIGHTEX_COMP_WARN_HOKSECONDARYMONITOR_MASTERSECONDARYCOMMUNICATIONERROR
Setting Conditions	Communication error reported from the Hokuyo UAM between the Primary and Secondary Proximity sensors
When Monitored	Always
Possible Causes	RS485 Communication wiring failure. Interference in the RS485 communication lines.
Initial Action	

Troubleshooting Steps

1. Check integrity of RS485+ and RS485- communication wires between the two safety sensors.

2. Check the integrity of the chassis ground wire between the two sensors (J14-J to J13-U) and that it is connected to the cable braided shield at each connector end.

5-E546 Master Unit Error

Description	Hokuyo Secondary Laser Error 64: Master Laser Error Reported
Fault Name	KNIGHTEX_COMP_WARN_HOKSECONDARYMONITOR_MASTERUNITERROR
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	Master (Left) Safety Sensor is in a fault condition RS 485 communication lines
Initial Action	

Troubleshooting Steps

1. Check the Master (Left) Safety Sensor for fault code and diagnose that first.
2. Check integrity of RS485+ and RS485- communication wires between the two safety sensors.
3. Check the integrity of the chassis ground wire between the two sensors (J14-J to J13-U) and that it is connected to the cable braided shield at each connector end.

5-E547 Optical Window Contamination

Description	Hokuyo Secondary Laser Error 84-85: Optical Window Contamination
Fault Name	KNIGHTEX_COMP_WARN_HOKSECONDARYMONITOR_OPTICALWINDOWCONTAMINATION
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	Optical window (lens) may be dirty or obscured
Initial Action	

Troubleshooting Steps

1. Clean the lens. If the code persists, the lens may be damaged.
2. If the lens is scratched or damaged, replace the Safety Sensor lens. See instruction sheet IS56090416

5-E548 Reference Monitor Error

Description	Hokuyo Secondary Laser Error AA: Reference Monitor Failure. Laser may not be mounted properly
Fault Name	KNIGHTEX_COMP_WARN_HOKSECONDARYMONITOR_REFERENCEMONITORERROR
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	Laser is displaced or not properly positioned
Initial Action	Check that the safety sensor is securely mounted.

Troubleshooting Steps

Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E54A Optical Window Removed

Description	Hokuyo Secondary Laser Error C1: Reference Monitor Failure. Laser may not be mounted properly
Fault Name	KNIGHTEX_COMP_WARN_HOKSECONDARYMONITOR_OPTICALWINDOWREMOVED
Setting Conditions	Error reported from the Hokuyo UAM Proximity Sensor
When Monitored	Always
Possible Causes	Laser window (lens) is missing
Initial Action	

Troubleshooting Steps

1. Check for missing laser window. If missing, check for internal sensor physical damage
    a. If there is no damage to the sensor, replace the Safety Sensor lens. See instruction sheet IS56090416
    b. If there is damage to the sensor, replace the safety sensor

5-E54B Adjustment Error

Description	Hokuyo Secondary Laser Error CE: Optical Window Adjustment Error
Fault Name	KNIGHTEX_COMP_WARN_HOKSECONDARYMONITOR_OPTICALWINDOWADJUSTMENTERROR
Setting Conditions	Error reported from the Hokuyo UAM. UAM Laser optical window not properly adjusted.
When Monitored	Always
Possible Causes	Adjustment of the optical window (lens) is incomplete after replacement. (Displays CE during the adjustment of the optical window.)
Initial Action	

Troubleshooting Steps

Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E590 3D Sens Check Fail

Description	3D Vision Sensor value check failed.
Fault Name	KNIGHTEX_COMP_WARN_CAMERA2_LEFTADCGAIN
Setting Conditions	Camera internal calibration left ADC gain value is out of range.
When Monitored	Always
Possible Causes	Old camera that has a bad internal calibration.
Initial Action	Replace 3D Camera

5-E591 3D Sens Check Fail

Description	3D Vision Sensor value check failed.
Fault Name	KNIGHTEX_COMP_WARN_CAMERA2_LEFTBLOFFSET
Setting Conditions	Camera internal calibration left blob offset value is out of range.
When Monitored	Always

Possible Causes	Old camera that has a bad internal calibration.
Initial Action	Replace 3D Camera

5-E592 3D Sens Check Fail

Description	3D Vision Sensor value check failed.
Fault Name	KNIGHTEX_COMP_WARN_CAMERA2_LEFTVRAMP
Setting Conditions	Camera internal calibration left VRamp value is out of range.
When Monitored	Always
Possible Causes	Old camera that has a bad internal calibration.
Initial Action	Replace 3D Camera

5-E593 3D Sens Check Fail

Description	3D Vision Sensor value check failed.
Fault Name	KNIGHTEX_COMP_WARN_CAMERA2_RIGHTADCGAIN
Setting Conditions	Camera internal calibration ADC value is out of range.
When Monitored	Always
Possible Causes	Old camera that has a bad internal calibration.
Initial Action	Replace 3D Camera

5-E594 3D Sens Check Fail

Description	3D Vision Sensor value check failed.
Fault Name	KNIGHTEX_COMP_WARN_CAMERA2_RIGHTBLOFFSET
Setting Conditions	Camera internal calibration VRamp value is out of range.
When Monitored	Always
Possible Causes	Old camera that has a bad internal calibration.
Initial Action	Replace 3D Camera

5-E595 3D Sens Check Fail

Description	3D Vision Sensor value check failed.
Fault Name	KNIGHTEX_COMP_WARN_CAMERA2_RIGHTVRAMP
Setting Conditions	Camera internal calibration VRamp value is out of range.
When Monitored	Always
Possible Causes	Old camera that has a bad internal calibration.
Initial Action	Replace 3D Camera

5-E5A0 2D Laser Delayed

Description	This fault code is no longer used.

Fault Name	KNIGHTEX_COMP_WARN_LASER_DELAYED

5-E600 Platform PCB Fault

Description	Platform PCB has an issue. See other fault codes
Fault Name	KNIGHTEX_COMP_ERR_AUTOSAFETY2_PLATFORMPCB
Setting Conditions	General error reported in the platform board
When Monitored	Auto Mode
Possible Causes	Scrubber had a sensor communication failure.
Initial Action	

Troubleshooting Steps

Reboot the machine and try to recreate the conditions of when it happened. Look for other faults for the cause (Likely drop-off sensor or mapping LIDAR)

5-E601 Steering Encoder

Description	Steering Encoder needs calibration
Fault Name	KNIGHTEX_COMP_ERR_AUTOSAFETY2_STEERINGENCODER
Setting Conditions	
When Monitored	Auto Mode
Possible Causes	
Initial Action	Perform the steering calibration procedure.

5-E602 Drop-Off Calibration

Description	Failed to determine an accurate drop-off threshold
Fault Name	KNIGHTEX_COMP_ERR_AUTOSAFETY2_DROPOFFCONFIG
Setting Conditions	No valid drop-off configuration found
When Monitored	Auto Mode
Possible Causes	Drop-off sensor not calibrated.
Initial Action	Calibrated drop-off sensor to floor.

Troubleshooting Steps

Consult the drop-off calibration procedure.

5-E611 Up Ramp or Motor Fail

Description	Motor Failed or driving up ramp
Fault Name	KNIGHTEX_COMP_ERR_AUTO3_TRACTIONLOST
Setting Conditions	Motor effort (traction) commanded doesn't match motor effort feedback.
When Monitored	Auto Mode
Possible Causes	Scrubber is stuck on something on the ground. Motor failure.
Initial Action	

5-E612 Down Ramp

No longer used.

5-E613 Obstructed Prox and Path

Description	Proximity Sensor and Path is blocked
Fault Name	KNIGHTEX_COMP_ERR_AUTO3_NOPRIMITIVEANDNOPROXIMITY
Setting Conditions	Both the autonomy and the Proximity LIDAR detected an obstacle on path
When Monitored	Auto Mode
Possible Causes	Obstacle on path
Initial Action	Remove obstacle or move scrubber

Troubleshooting Steps

If this kickout continues, consider retraining the path.

5-E616 UV Bulb Not Changing

Description	The UV bulb is not turning on as requested
Fault Name	KNIGHTEX_COMP_ERR_AUTO3_UV
Setting Conditions	UV light got disconnected or isn't reporting the correct value.
When Monitored	Auto Mode
Possible Causes	Something unplugged or got caught on the UV sensor.
Initial Action	Plug UV light back in. Move thing that got caught on the UV light.

5-E617 Failed Load Plan

Description	Failed to load a plan for running
Fault Name	KNIGHTEX_COMP_ERR_AUTO3_PLANLOADFAIL
Setting Conditions	Failure loading the plan to playback.
When Monitored	Start of Auto Mode
Possible Causes	Internal software error.
Initial Action	Retrain plan.

5-E618 Failed GP Plan Prep

Description	Global Planner failed to load a plan for running
Fault Name	KNIGHTEX_COMP_ERR_AUTO3_GLOBALPLANNERPLANPREP
Setting Conditions	Timeout waiting for the global planner to generate the plan.
When Monitored	Start of Auto Mode
Possible Causes	Over 8 hour fill-in plan.
Initial Action	Train smaller plan.

5-E61D Vehicle Not Moving

Description	Detected that vehicle is not moving
Fault Name	KNIGHTEX_COMP_ERR_AUTO3_VEHICLENOTMOVING
Setting Conditions	Vehicle has not moved for 60 seconds.
When Monitored	Auto Mode
Possible Causes	The vehicle could be stuck trying to figure out how to proceed. The vehicle is not able to figure out a way to move forward.
Initial Action	Move obstacle. Retrain plan.

5-E621 Temp Error

Description	Hokuyo Secondary Laser Error 72: Operating Temp Error
Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYHARDWARE_OPERATINGTEMPERROR
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	Safety Sensor temperature is out of allowed range: -10ºC to +50ºC (No freezing)
Initial Action	Operate the machine in an environment which is within the allowed temperature
range.	

Troubleshooting Steps

If the sensor temperature is not outside the allowed range and the code continues to reset, replace the sensor. Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E622 Power Supply Error

Description	Hokuyo Secondary Laser Error 74-79: Power Supply Voltage Out Spec
Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYHARDWARE_POWERSUPPLYERROR
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	Power supply voltage is less than16.8V or more than 28.8V
Initial Action	Charge the machine batteries overnight

Troubleshooting Steps

1. Check the machine battery voltage. If it is within a normal level, continue.
    - Check the power supply to the safety sensor.
    - If the power supply is low, trace down the source of the voltage drop.
    - If the power supply is okay but the code continues to set, replace the sensor.

Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E623 EDMI 1 Input Error

Description	Hokuyo Secondary Laser Error A6: EDM1 input connection error
Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYHARDWARE_EDMI1INPUTERROR

Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	EDM1 connection failure
Initial Action	

Troubleshooting Steps

Power cycle the machine. Attempt to playback a plan. If the code persists, replace the safety sensor.

Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E624 EDMI 2 Input Error

Description	Hokuyo Secondary Laser Error A7: EDMI2 input connection
Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYHARDWARE_EDMI2INPUTERROR
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	EDM2 connection failure
Initial Action	

Troubleshooting Steps

Power cycle the machine. Attempt to playback a plan. If the code persists, replace the safety sensor.

Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E625 Input Reset Error

Description	Hokuyo Secondary Laser Error A9: Operating Temp Error
Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYHARDWARE_INPUTRESETERROR
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	
Initial Action	

Troubleshooting Steps

Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E626 OSSD Excess Current

Description	Hokuyo Secondary Laser Error 7C: OSSD Excess Current
Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYHARDWARE_OSSDEXCESSCURRENT
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	There is too much current through one of the OSSD lines
Initial Action	

Troubleshooting Steps

1. Check all OSSD lines for possible short to battery negative.
    - If the lines are okay, replace the safety sensor

Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E627 OSSD Diagnostic Error

Description	Hokuyo Secondary Laser Error 95-9A: OSSD Diagnostic Error
Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYHARDWARE_OSSDDIAGERROR
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	An open OSSD circuit
Initial Action	

Troubleshooting Steps

1. Check the integrity of all OSSD circuits between the autonomous controller and each safety sensor.
    - Check that each circuit is complete
    - Check that none are shorted together
    - Check that none are shorted to battery positive or battery negative

Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E630 Incomplete Configuration

Description	Hokuyo Secondary Laser Error 45: Setting Error or Incomplete Configuration
Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYSOFTWARE_CONFIGURATIONERROR
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	The sensor is not properly configured
Initial Action	

Troubleshooting Steps

Reconfigure the safety sensor using the Hokuyo UAM Project Designer application with a laptop and the corresponding configuration file (right or left). See “Liberty SC50 Downloads” in EzParts.

Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E631 Configuration Error

Description	Hokuyo Secondary Laser Error 45: Setting error r Incomplete Settings
Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYSOFTWARE_CONFIGURATIONERROR2
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	Light Interference from another LIDAR sensor. Highly reflective surface causing interference.
Initial Action	

Troubleshooting Steps

Check for sources of light interference from reflective surfaces or other LIDAR sources. Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E632 UAM not configured

Description	Hokuyo Secondary Laser Error CF: UAM is not configured
Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYSOFTWARE_UAMNOTCONFIGURED
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	Light Interference from another LIDAR sensor. Highly reflective surface causing interference.
Initial Action	

Troubleshooting Steps

Check for sources of light interference from reflective surfaces or other LIDAR sources. Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E633 UAM configuration incomplete

Description	Hokuyo Secondary Laser Error D3-E6: UAM configuration is incomplete.
Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYSOFTWARE_UAMCONFIGUREINCOMPLETE
Setting Conditions	Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	Light Interference from another LIDAR sensor. Highly reflective surface causing interference.
Initial Action	

Troubleshooting Steps

Check for sources of light interference from reflective surfaces or other LIDAR sources. Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E642 Area sequence error

Description	Hokuyo Secondary Laser Error 58: Area sequence error
Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYMONITOR_AREASEQUENCEERROR
Setting Conditions	Error occurred during area switching sequence reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	Area Address Wiring Failure Sensor Failure interference.
Initial Action	

Troubleshooting Steps

1. Check the area address voltages on J11-3 through J11-12. Make sure each address line and its compliment are opposite one another. (See “Sample Shop Voltage Measurements”).

Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E650 Mutual Interference Error

Description	Hokuyo Secondary Laser Error 86: Mutual Interference Error

Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYMISC_MUTUALINTERFERENCEERROR
Setting Conditions	Safety sensor is experiencing laser interference from the other safety sensor. Error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	Safety sensors not mounted properly.
Initial Action	

Troubleshooting Steps

1. Make sure both safety sensors are mounted properly.

Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E651 Other Error

Description	Hokuyo Secondary Laser Error 41-F5: Other Error
Fault Name	KNIGHTEX_COMP_ERR_HOKSECONDARYMISC_OTHERERROR
Setting Conditions	Unclassified error reported from the Hokuyo UAM
When Monitored	Always
Possible Causes	Malfunctioning Proximity Sensor
Initial Action	Power Cycle the machine

Troubleshooting Steps

1. Check that the sensor chassis ground wire is properly connected to battery negative.
2. Make sure the safety sensors are mounted securely.
3. Power cycle the machine. If the fault persists, replace the safety sensor.

Consult Proximity LIDAR Hokuyo UAM manual for more information.

5-E660 Safety Pwr Interlock

Description	Interlock not staying low
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_PWRINTERLOCK
Setting Conditions	Platform board detected the interlock line isn't staying low when disconnected.
When Monitored	Bootup
Possible Causes	Bad wiring, short to the interlock line.
Initial Action	Inspect cabling

Additional Information

The interlock line should be low when the platform board isn't applying voltage to the line. This is a fail safe to stop the scrubber.

If interlock line is high, the system will fail-unsafe.

5-E661 Safety Pwr Voltage

Description	Platform voltage exceeding thresholds

Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_PWRVOLTRANGE
Setting Conditions	Platform board detected the input voltage is outside of range.
When Monitored	Always
Possible Causes	Short circuit or bad wiring
Initial Action	Reboot scrubber

Additional Information

System will shutdown after issuing this fault.

5-E662 Safety Temp Range

Description	Temperature < -10 or > 80 degrees C
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_PWRTEMPRANGE
Setting Conditions	Platform board is operating outside of the temperature change.
When Monitored	Always
Possible Causes	System is too hot or cold
Initial Action	Reboot scrubber.

Additional Information

System will start shutting down after sending this EMCY code.

5-E663 Safety PCB Cable

Description	Unused
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_PWRCOMPPCBCABLE

5-E664 Safety Comp PCB

Description	Compute Board hardware is unresponsive on boot
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_PWRCOMPPCB
Setting Conditions	Platform board detected an error with the power going to the compute board.
When Monitored	Always
Possible Causes	Power issue internal to the autonomy module.
Initial Action	Replace Autonomy Module

5-E665 Safety Power 2D Map Sensor

Description	Mapping Sensor did not acknowledge power-up
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_PWR2DSENS
Setting Conditions	Platform board detected a power issue with the 2D Mapping LIDAR.
When Monitored	Always
Possible Causes	Malfunctioning 2D Mapping LIDAR
Initial Action	Fix 2D Mapping LIDAR

5-E666 Safety Comp PCB Config

Description	Unused
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_PWRCOMPPCBCFG

5-E667 Safety PCB Config

Description	Unused
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_PWRSAFETYPCBCFG

5-E668 Safety Bootload Mode

Description	Platform board is updating, safety line set
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_BOOTLOADMODE
Setting Conditions	Platform board is in a boot loading mode to update the software to the latest version.
When Monitored	Bootup
Possible Causes	New version of software
Initial Action	Power cycle the system when the update completes.

5-E669 Safety Can Server Conn

Description	Lost CAN Comm between Compute and Platform
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_CANSERVERCONN
Setting Conditions	Platform board's can communication to the autonomy kit was dropped.
When Monitored	Always
Possible Causes	Software issue in the autonomy kit.
Initial Action	If there is no loss of operation, do nothing. If the scrubber is not working, reboot.

5-E66A Safety IMU

Description	IMU not booting
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_IMU
Setting Conditions	Platform board detected a problem with the IMU.
When Monitored	Always
Possible Causes	Broken IMU
Initial Action	Replace Autonomy module

5-E66B Safety Comp Conn

Description	Lost NV Comm between Compute and Platform
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_NOCOMPCONN
Setting Conditions	In the Autonomy Module, the platform board doesn't have a connection to the compute board.
When Monitored	Always
Possible Causes	Software issue or wiring issue internal to the Autonomy Kit.

Initial Action	Reboot scrubber

5-E66C Safety Forced Unsafe

Description	Compute board forced unsafe
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_FORCEDUNSAFE
Setting Conditions	The autonomy kit forced the interlock line to assert, stopping the scrubber.
When Monitored	Auto Mode
Possible Causes	This is done as part of testing how well the vehicle can stop using the interlock.
Initial Action	Normal Testing Operation

5-E66D Safety 2D Map Pulse

Description	No Sync Pulse Line from 2D Mapping Sensor
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_LASERNOPULSE
Setting Conditions	Autonomy kit isn't getting a pulse from the 2D Mapping LIDAR
When Monitored	Always
Possible Causes	Broken 2D Mapping LIDAR or damaged cables.
Initial Action	Inspect 2d Mapping LIDAR and cabling.

5-E66E Safety No Comp Data

Description	Compute board stopped sending NV data
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_NOCOMPDATA
Setting Conditions	Inside the autonomy kit, the platform board isn't seeing any data from the compute board.
When Monitored	Always
Possible Causes	Software issue.
Initial Action	Ignore if it isn't causing an issue. Reboot if there is a problem.

5-E66F Safety No CAN Data

Description	Compute board stopped sending CAN data
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY_NOCANDATA
Setting Conditions	The Platform board stopped getting CAN data
When Monitored	Always
Possible Causes	Software lockup or issue with the CAN line.
Initial Action	Reboot scrubber. Inspect cables.

5-E670 Safety Auto 1

Description	This fault code is reserved for future use and is not currently used.
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY2_AUTOBIT1

5-E671 Safety Auto 2

Description	This fault code is reserved for future use and is not currently used.
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY2_AUTOBIT2

5-E672 Safety Auto 3

Description	This fault code is reserved for future use and is not currently used.
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY2_AUTOBIT3

5-E673 Safety Auto 4

Description	This fault code is reserved for future use and is not currently used.
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY2_AUTOBIT4

5-E674 Safety Auto 5

Description	This fault code is reserved for future use and is not currently used.
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY2_AUTOBIT5

5-E675 Safety Auto 6

Description	This fault code is reserved for future use and is not currently used.
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY2_AUTOBIT6

5-E676 Safety Auto 7

Description	This fault code is reserved for future use and is not currently used.
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY2_AUTOBIT7

5-E677 Safety Auto 8

Description	This fault code is reserved for future use and is not currently used.
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY2_AUTOBIT8

5-E678 Safety Comp Network

Description	This fault code is no longer used.
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY2_NOCOMPNETWORK

5-E679 Safety 2D Map Network

Description	This fault code is no longer used.
Fault Name	KNIGHTEX_COMP_ERR_PLATSAFETY2_NOLASERNETWORK

5-E680 Figure Eight-like Loop in Plan

Description	The plan perimeter contained a figure-8 like loop with a single point of intersection
Fault Name	KNIGHTEX_COMP_ERR_TRAIN2_FIGUREEIGHT

Setting Conditions	Operator trained a path in a figure 8 pattern.
When Monitored	Training
Possible Causes	Operator trained a figure 8 fill-in path.
Initial Action	Train a circle around the area you want to clean.

5-F040 Deprecated

Description	Unused
Fault Name	KNIGHT_PLAT_INFO_PWER_IDLE

5-F041 Key Shutdown

Description	Operator shutdown the scrubber. Expected behavior.
Fault Name	KNIGHT_PLAT_INFO_PWER_KEY
Setting Conditions	The KSI line to the autonomous module became inactive.
When Monitored	Always
Possible Causes	Operator shutdown the scrubber. KSI relay/circuit failure.
Initial Action	Make sure smartkey is still present

Troubleshooting Steps

Because the main controller needs to be active in order to report this error, it is known that the error must lie at or downstream from the KSI relay. If the main machine controller is reporting a KSI failure, refer to the Main Machine Controller (E2) Error Codes for troubleshooting steps.

1. Verify that the voltage between X28 (gray wire) at the KSI relay and the main grounding lug in the lower electronics bay, is at battery voltage.
    - This is assumed true, otherwise the main controller would report a KSI error.
2. Check the voltage between contacts J6-21 and J6-22 at the autonomous module.
    - If the voltage is not at or near 24 volts, repair or replace the harness between the autonomous controller and the KSI relay.
    - If the voltage is at 24 volts, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-F042 Deprecated

Description	Unused
Fault Name	KNIGHT_PLAT_INFO_PWER_KBOARD

5-F043 Started Shutdown

Description	Automation shutdown initiated via the Compute Box
Fault Name	KNIGHT_PLAT_INFO_PWER_CBOARD
Setting Conditions	Started shut down sequence due to CLI, even if the switch is sub-subsequently turned back on. Informative only.
When Monitored	Never
Possible Causes	
Initial Action	

5-F047 Autonomy Power Off

Description	Platform board has shutdown
Fault Name	KNIGHT_PLAT_INFO_PWER_OFF
Setting Conditions	Platform Board detected a shutdown request from the Compute Board. This is used for internal testing.
When Monitored	Always
Possible Causes	

Initial Action	

Troubleshooting Steps

This occurs if a quick reboot is performed before the Autonomy controller is fully powered down, and can be ignored.

5-F246 No Map Sensor ACK

Description	Mapping Sensor did not acknowledge power-up
Fault Name	KNIGHT_PLAT_ERR_PWER_LASER
Setting Conditions	Mapping Laser did not assert the Sync/Ready line high at startup.
When Monitored	Boot-up
Possible Causes	No power to the laser. Faulty laser module. Open circuit on pin 2 of laser power cable.
Initial Action	Reboot the machine

Troubleshooting Steps

1. Laser module indicator lights are not illuminated
    a. Disconnect and re-seat the power cable between the autonomous module and the laser.
        - If the indicator lights illuminate, reboot the system to validate the repair.
    b. Disconnect the power cable at the laser module.
    c. Check the voltage between pins 1 and 3 of the power cable (upper image).
        - If the voltage is at or near 24 volts, replace the laser module.
    d. Disconnect the power cable from the autonomous module.
    e. Check the voltage between pins 1 and 3 of the autonomous module (lower image).
        - If the voltage is at or near 24 volts, replace the power cable.
        - If the voltage is not 24 volts, replace the autonomous module.
2. Laser module indicator lights are illuminated.
    a. Disconnect the cable from both the autonomous module and the laser module.
    b. Check the continuity between pin 2 at both ends of the cable.
        - If there is no continuity, replace the cable.
        - If there is continuity, the fault lies with one of the two modules. Swap each module separately to determine which one is at fault.

5-F270 Platform/Comp Ether

Description	Platform Board has lost Ethernet communication with the Compute Board

Fault Name	KNIGHT_PLAT_ERR_COMM_LOSTDATACOMM
Setting Conditions	Platform Board has lost Ethernet communication with the Compute Board
When Monitored	Always
Possible Causes	Software bug or internal cabling issue
Initial Action	Power cycle scrubber

Troubleshooting Steps

Reboot the machine. If the error persists, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-F271 Plat/Autonomy Ether

Description	Unused
Fault Name	KNIGHT_PLAT_ERR_COMM_LOSTCANCOMM

5-F272 Platform/Compute

Description	Platform Board can't ping Compute Board through Ethernet cable
Fault Name	KNIGHT_PLAT_ERR_COMM_LOSTCOMPUTEBOXETH
Setting Conditions	Platform Board can’t ping Compute Board through Ethernet cable
When Monitored	Always
Possible Causes	Software issue or internal cabling issue
Initial Action	If there isn't an issue this message can be ignored.

Troubleshooting Steps

Reboot the machine. If the error persists, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-F273 Plat/Mapping Eth

Description	Platform Board can't ping SICK Mapping Sensor through Ethernet cable
Fault Name	KNIGHT_PLAT_ERR_COMM_LOSTMAPPINGLASERETH
Setting Conditions	Platform Board can’t ping SICK Mapping Laser through Ethernet cable
When Monitored	Always
Possible Causes	Faulty cable. Faulty mapping laser.
Initial Action	Reboot the System

Troubleshooting Steps

1. Inspect the Ethernet cable connectors at both the autonomous module and mapping laser for proper tightness.
2. Check the indicator light on the mapping laser to make sure the module is operating.
3. Temporarily swap out the Ethernet cable with a known good cable.
4. If none of the above steps corrected the problem, replace the mapping laser.

5-F274 Plat/Safety Sens L

Description	Unused

Fault Name	KNIGHT_PLAT_ERR_COMM_LOSTSAFETYLASERONEETH

5-F275 Plat/Safety Sens R

Description	Unused
Fault Name	KNIGHT_PLAT_ERR_COMM_LOSTSAFETYLASERTWOETH

5-F290 Low Power Reset

Description	The reset reason sent by the platform board is the Low-Power Reset
Fault Name	KNIGHT_PLAT_ERR_RESETREASON_LPWR
Setting Conditions	This fault reports how the platform board in the Autonomy module turned off the last time it was on. It this case, it turned off from low power.
When Monitored	Bootup
Possible Causes	Low Battery voltage caused the machine to turn off
Initial Action	Check Battery

5-F291 Wind. Watchdog Reset

Description	The reset reason sent by the platform board is the Window Watchdog tripped
Fault Name	KNIGHT_PLAT_ERR_RESETREASON_WWDG
Setting Conditions	This fault reports how the platform board in the Autonomy module turned off the last time it was on. It this case, it turned off a software crash not resetting the software watchdog in time.
When Monitored	Boot-up
Possible Causes	Software bug
Initial Action	No Action needed

5-F292 Ind. Watchdog Reset

Description	The reset reason sent by the platform board is the Internal watchdog tripped
Fault Name	KNIGHT_PLAT_ERR_RESETREASON_IWDG
Setting Conditions	This fault reports how the platform board in the Autonomy module turned off the last time it was on. It this case, it turned off a software crash not resetting the software watchdog in time.
When Monitored	Boot-up
Possible Causes	Software bug
Initial Action	No Action needed

5-F293 Software Reset

Description	The reset reason sent by the platform board is the Software Reset
Fault Name	KNIGHT_PLAT_ERR_RESETREASON_SFTW
Setting Conditions	This fault reports how the platform board in the Autonomy module turned off the last time it was on. It this case, it turned off because the software was reset.
When Monitored	Boot-up
Possible Causes	If the scrubber is turned on before it fully turned off, it will issue this fault.
Initial Action	No Action needed

5-F344 Temp Shutdown

Description	Automation shutdown initiated via temperature threshold
Fault Name	KNIGHT_PLAT_FATAL_PWER_TTHRESH
Setting Conditions	This code is triggered by other temperature codes to indicate a When Monitored
shutdown status.	
When Monitored	Always
Possible Causes	See accompanying code
Initial Action	

5-F345 Voltage Shutdown

Description	Automation shutdown initiated via voltage threshold
Fault Name	KNIGHT_PLAT_FATAL_PWER_VTHRESH
Setting Conditions	This code is triggered by other voltage codes to indicate a shutdown status.
When Monitored	Always
Possible Causes	
Initial Action	

5-F400 Wrong Port

Description	This fault code is no longer used.
Fault Name	KNIGHT_COMP_INFO_PLAT_WRONGPORT

5-F401 No Hardware ACK

Description	Compute Board hardware is unresponsive on boot
Fault Name	KNIGHT_COMP_INFO_PLAT_HWACK
Setting Conditions	Compute Board hardware is unresponsive on boot
When Monitored	Boot-up
Possible Causes	Internal error. Compute board could be malfunctioning.
Initial Action	Reboot the machine.

Troubleshooting Steps

Reboot the machine. If the error persists, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-F402 No Software ACK

Description	Unused
Fault Name	KNIGHT_COMP_INFO_PLAT_SWACK

5-F41C No Platform SW

Description	No embedded board firmware is contained in this software image
Fault Name	KNIGHT_COMP_INFO_BOOT_NOBOARDS
Setting Conditions	The embedded image dir is empty, this is probably a development build.
When Monitored	Auto Mode
Possible Causes	Development build of software
Initial Action	Upgrade to a official release image instead of a test image.

5-F421 Set Home OK

Description	Successfully set home position
Fault Name	KNIGHT_COMP_INFO_HOMING_SETHOMEOK
Setting Conditions	Vehicle successfully homed to a location tag.
When Monitored	When Lost
Possible Causes	Normal Operation
Initial Action	

5-F422 No Home Position

Description	There is no home position set
Fault Name	KNIGHT_COMP_INFO_HOMING_NOHOMEPOS
Setting Conditions	The scrubber is not localized. It doesn’t know its location
When Monitored	Always
Possible Causes	Location tag not set
Initial Action	Drive to a location tag and set the home position.

5-F426 Tag Already Saved

Description	Refusing to overwrite already saved tag
Fault Name	KNIGHT_COMP_INFO_HOMING_TAGEXISTS
Setting Conditions	Attempting to save location tag that is already set as home
When Monitored	Always
Possible Causes	The same location tag is used in two different locations
Initial Action	Use a different location tag.

5-F427 Wrong Location Tag

Description	The detected location tag is not saved location tag
Fault Name	KNIGHT_COMP_INFO_HOMING_UNSAVEDTAG
Setting Conditions	The current location tag in front of the Scrubber has not been previously set as a home position
When Monitored	When Lost
Possible Causes	
Initial Action	

Troubleshooting Steps

This emcy code will no longer be used in later versions of software.

5-F428 Map Resets Soon

Description	Mapping system will reset soon because of too much data
Fault Name	KNIGHT_COMP_INFO_HOMING_SLAMRESETSOON
Setting Conditions	Mapping data is approaching its limit.
When Monitored	Localized
Possible Causes	System is running out of memory to store all the mapping data
Initial Action	Re-localize to tag

5-F429 Map Reset

Description	Mapping system reset because of too much data
Fault Name	KNIGHT_COMP_INFO_HOMING_SLAMRESET
Setting Conditions	Mapping data exceeded capacity
When Monitored	Localized
Possible Causes	Mapped area too large
Initial Action	After path finishes, localize to tag.

Troubleshooting Steps

The scrubber won't be able to start the next auto mode until localizing to a tag.

This fault doesn't cause the scrubber to exit auto mode.

5-F42A Tag Deleted

Description	The last seen tag was successfully removed from the tag database.
Fault Name	KNIGHT_COMP_INFO_HOMING_TAGDELETED
Setting Conditions	A Location Tag was successfully deleted.
When Monitored	When attempting to delete a tag
Possible Causes	Normal Operation
Initial Action	

5-F42B Tform not preset

Description	Tform is not present becuase something is not publishing it
Fault Name	KNIGHT_COMP_INFO_HOMING_TFORMUNAVAILABLE
Setting Conditions	Location from scrubber to location tag is not available.
When Monitored	Auto Mode
Possible Causes	Scrubber got lost in the map that keeps track of the location tag.
Initial Action	No action needed, no loss of operation. When scrubber exits auto it may take a while to resume the path. Home to the location tag if that happens.

5-F42C Tag Too Close

Description	Location Tag is too close to the robot
Setting Conditions	Vehicle is too close to the location tag
When Monitored	Homing
Possible Causes	Tag not mounted on wall.
Initial Action	Mount tag on wall. Move vehicle further away from wall.

Troubleshooting Steps

The location tag has to be fixed onto the wall, once the scrubber localizes to the tag, the tag should not be moved.

5-F431 Update No Connect

Description	No connection could be made to the update server
Fault Name	KNIGHT_COMP_INFO_UPDATE_NOCONNECTION
Setting Conditions	Autonomy Board was unable to connect to the internet to check for updates
When Monitored	Always
Possible Causes	No connection to the internet.
Initial Action	Connect to building wifi or TrackClean to download updates

Troubleshooting Steps

If network isn't configured See procedure for configuring network.

5-F433 Bad update download

Description	No valid update could be downloaded
Fault Name	KNIGHT_COMP_INFO_UPDATE_NODOWNLOAD
Setting Conditions	No valid update could be downloaded
When Monitored	Always
Possible Causes	Internal issue with update or running a development version of software.
Initial Action	Upgrade to released stable version of software.

5-F444 Log Upload Busy

Description	The log upload was skipped because an upload was already in progress
Fault Name	KNIGHT_COMP_INFO_LOG_UPLOADSKIPPED
Setting Conditions	Log upload connection to internet timed out. No loss of operation
When Monitored	During Upload
Possible Causes	Slow Internet Connection
Initial Action	Relocate the machine to an area of better WiFi signal.

Troubleshooting Steps

If uploading over the IoT module. Inspect the IOT module for damage.

5-F445 Log Upload Failed

Description	The log upload has failed
Fault Name	KNIGHT_COMP_INFO_LOG_UPLOADFAILED
Setting Conditions	Failed to complete log upload. No loss of operation.
When Monitored	During Upload
Possible Causes	Intermittent Internet Connection
Initial Action	Relocate the machine to an area of better WiFi or cellurlar network signal.

Troubleshooting Steps

Inspect the IOT module for damage.

5-F447 Set Log Dir Failed

Description	Setting active logging directory has failed
Fault Name	KNIGHT_COMP_INFO_LOG_SETACTIVEDIRFAILED
Setting Conditions	Unable to write logs to the logging directory
When Monitored	Always
Possible Causes	Log directory not properly mounted on the harddrive. Due to file system corruption.
Initial Action	Reboot scrubber to repair file system.

5-F452 Stuck on Obstacles

Description	Auto-scrub unable to continue, two different obstacles
Fault Name	KNIGHT_COMP_INFO_AUTO_NOPRIMITIVE
Setting Conditions	The 3D Camera sees one obstacle and the Mapping Laser sees a separate obstacle. The scrubber can’t navigate through these obstacles.
When Monitored	Auto Mode
Possible Causes	Objects may not be visible to one type of sensor, but visible by the other.not to the other.
Initial Action	Remove obstacles, if present.

Troubleshooting Steps

If no obstacles present, calibrate the 3D vision sensor (camera)

5-F454 Auto when Lost

Description	Unable to enter Auto-scrub, scrubber is lost
Fault Name	KNIGHT_COMP_INFO_AUTO_LOST
Setting Conditions	The system exited auto for being lost.
When Monitored	Auto Mode
Possible Causes	The system can't find itself in the environment.
Initial Action	Retrain path. The environment may have significantly changed since the plan was trained.

5-F455 Outside Safe Area

Description	Auto-scrub unable to continue, outside the safe zone
Fault Name	KNIGHT_COMP_INFO_AUTO_SAFEZONE
Setting Conditions	Scrubber is outside of the Safe Area.
When Monitored	Always
Possible Causes	Localization issues, if the environment changed significantly.
Initial Action	Return scrubber to path and resume.

Troubleshooting Steps

If the environment may have changed significantly since the path was trained. Retrain path to update the map.

5-F456 Can't Find Path

Description	Auto-scrub unable to continue. Can't find path to continue.
Fault Name	KNIGHT_COMP_INFO_AUTO_NOPATH
Setting Conditions	The planner is not able to find a path to continue scrubbing. Obstacles on the path.
When Monitored	Auto mode
Possible Causes	Obstacles in the way
Initial Action	Move the obstacles.

Troubleshooting Steps

If no obstacles present, calibrate the 3D vision sensor (camera). It may have moved during normal operation.

5-F45A 3D Sensor Obstacle

Description	Auto-scrub unable to continue, camera obstacle blocking all plans
Fault Name	KNIGHT_COMP_INFO_AUTO_CAMERANOPRIM
Setting Conditions	3D Camera detected an obstacle in the way
When Monitored	Auto Mode
Possible Causes	The 3D Camera is dirty. Camera is malfunctioning. Camera isn't properly calibrated.

Initial Action	Clean Camera

Troubleshooting Steps

If the problem persists, calibrate the 3D vision sensor (camera)

5-F45B Map Sensor Obstacle

Description	Auto-scrub unable to continue, Mapping Sensor obstacle blocking all plans
Fault Name	KNIGHT_COMP_INFO_AUTO_LASERNOPRIM
Setting Conditions	Mapping Laser detected an obstacle in the way
When Monitored	Auto Mode
Possible Causes	The Mapping Laser is dirty. Obstacle in the way.
Initial Action	Clean Mapping Laser. Move obstacle

5-F45C 2D and 3D Obstacle

Description	Auto-scrub unable to continue, obstacle seen by 3D Stereo Camera and SICK Mapping Sensor
Fault Name	KNIGHT_COMP_INFO_AUTO_BOTHLAYERNOPRIM
Setting Conditions	Both the 3D Camera and the Mapping laser detected an obstacle in the way
When Monitored	Auto Mode
Possible Causes	Obstacle
Initial Action	Move obstacle.

Troubleshooting Steps

Because an obstacle is detected by 2 separate systems, it is unlikely that this is a false-positive error. However, if no obstacles are present, clean both sensors and calibrate the 3D vision sensor.

5-F45D Operator Presence

Description	Auto-scrub unable to continue, the operator is on Scrubber
Fault Name	KNIGHT_COMP_INFO_AUTO_OPERATORPRESENCE
Setting Conditions	Autonomous controller detected that the operator was on the scrubber for more than 30 seconds
When Monitored	Auto Mode
Possible Causes	Operator on Scrubber
Initial Action	Get off scrubber to resume autoscrub

Troubleshooting Steps

If an operator was not on the scrubber there could be a short-circuit to battery positive in operator presence switch or circuit.

1. Inspect the operator presence foot pad for obstructions to returning to the up/neutral position.
    - Repair or replace the return springs if faulty.
2. While monitoring the operator presence input from the service menu, disconnect the harness connector for the operator platform.
    - If the switch status transitions from on to off, repair or replace the platform harness and/or switch.
    - If the switch status remains on, repair or replace the main harness between the platform and main controller.

5-F45E Auto-Scrub Exit

Description	Deprecated
Fault Name	KNIGHT_COMP_INFO_AUTO_OUTOFMEMORY
Setting Conditions	System ran out of memory
When Monitored	Always
Possible Causes	Memory leak or a very large area
Initial Action	

Troubleshooting Steps

The system ran out of memory. There are some ways to reduce the amount of memory the system uses.

- Reboot system after 6-8 hours.
- Train smaller area. Keep the trained path under 6-8 hours long.
- Move location tag closer to the start area. The system generates a map between the start area and the location tag.

5-F462 Conflicting plans

Description	Cannot delete plan in an area due to conflicting plans
Fault Name	KNIGHT_COMP_INFO_PLAN_CONFLICTINGDELETE
Setting Conditions	Operator attempted to delete a plan, however, the scrubber is currently on two plans. The scrubber doesn’t know which plan to delete
When Monitored	Manual Mode
Possible Causes	Operator trained two plans on top of each other and requested a delete. The Scrubber not sure which one to delete
Initial Action	Move the machine to an area of the plan not overlapped by another plan.

5-F470 User Cancel

Description	An operator canceled recording
Fault Name	KNIGHT_COMP_INFO_TRAIN_USERCANCEL
Setting Conditions	Clean Board sent CANBus command to cancel current training to Autonomy Module
When Monitored	Training Mode
Possible Causes	Normal Operation
Initial Action	To save the recording, save plan instead of cancel

Troubleshooting Steps

If this wasn't expected, examine the function of all membrane button switches in the Panel Test function of the service menu.

5-F474 Fail Record/No Home

Description	Failed to record due to no home position
Fault Name	KNIGHT_COMP_INFO_TRAIN_NOHOME

Setting Conditions	Attempt to train before a home position is set. Home does not exist.
When Monitored	Lost
Possible Causes	Operator attempted to train before setting home.
Initial Action	Set Home position before training.

5-F475 Fail Record - Lost

Description	Failed to record due to being lost. Scrubber has a home position.
Fault Name	KNIGHT_COMP_INFO_TRAIN_LOST
Setting Conditions	Attempt to train when scrubber hasn’t located the home position. Home exists, but the scrubber doesn’t know where it is located.
When Monitored	Lost
Possible Causes	Scrubber is lost
Initial Action	Drive to home position, and then train.

5-F476 Fail Record - Busy

Description	Failed to record due to scrubber being busy
Fault Name	KNIGHT_COMP_INFO_TRAIN_BUSY
Setting Conditions	Clean Board sent an invalid command when training
When Monitored	Manual Mode after Training
Possible Causes	The scrubber is processing the recorded plan.
Initial Action	Wait until plan finishes saving.

5-F478 Record Warn Drop-Off

Description	Operator recorded near drop-off Sensor
Fault Name	KNIGHT_COMP_INFO_TRAIN_DROPOFF
Setting Conditions	Drop-off Sensor detected during training. This is informational to user
When Monitored	Training
Possible Causes	The operator trained a plan by a drop-off or highly reflective surface.
Initial Action	To avoid a possible kickout during autoscrub, retrain the plan.

5-F479 No Loop

Description	The fill-in loop didn't close
Fault Name	KNIGHT_COMP_INFO_TRAIN_NOLOOP
Setting Conditions	The operator did not drive the Fill-in loop in a circle
When Monitored	Training
Possible Causes	The operator trained a fill-in plan that didn’t overlap the start area.
Initial Action	Re-train the plan and overlap the starting point.

Troubleshooting Steps

Check wheel encoders

- If the end point of the plan did overlap the beginning, then the wheel encoders may be at fault. Perform the validation testing for the wheel encoders to diagnose any problems.

Difficult to map area

- The area may be difficult to map. Due to highly reflective walls or walls that absorb mapping LIDAR returns. To help create better maps, the operator should train 2 loops. To train two loops.
  1. Train a loop, like usual.
  2. Instead of pressing save at the end of the loop, keep driving another loop.
  3. Once you reenter the loop a second time, then press save.

5-F47A Fail No Dropoff Calib

Description	Failed to record. Dropoff is not calibrated.
Fault Name	KNIGHT_COMP_INFO_TRAIN_DROPOFFNOTCALIBRATED
Setting Conditions	Attempting to train with drop-offs not calibrated.
When Monitored	Training
Possible Causes	Drop-off calibration is either missing or invalid
Initial Action	Calibrate drop-off sensor

5-F47B No Vacuum

Description	Recording with solution and no vacuum either both on or both off.
Fault Name	KNIGHT_COMP_INFO_TRAIN_NOVACCUM
Setting Conditions	Autonomy Module checked if solution is on without vacuum
When Monitored	Training
Possible Causes	The plan trained has solution enabled but did not have vacuum enabled.
Initial Action	Re-train with vacuum enabled.

Troubleshooting Steps

If you want to scrub the same area twice without vacuuming. Change the squeegee to double-scrub mode before autoscrubbing.

5-F47C Clockwise Plan

Description	A clockwise plan was recorded
Fault Name	KNIGHT_COMP_INFO_TRAIN_CLOCKWISE
Setting Conditions	Attempt to save a Fill-in plan with a clockwise direction.
When Monitored	Training
Possible Causes	
Initial Action	Train path in a counter-clock wise direction.

Additional Info

Since the scrubdeck is offset to the right of the scrubber. To better clean near edges, keep the right side of the scrubber toward the walls.

5-F47D Self Cross Plan

Description	The plan crossed itself outside of the start area
Fault Name	KNIGHT_COMP_INFO_TRAIN_CROSSSELF
Setting Conditions	The Fill-in plan that the operator trained crossed itself. Not clear what area to clean
When Monitored	Training
Possible Causes	Driving an unusal fill-in pattern such as a figure 8.
Initial Action	Train the plan counterclockwise around the area to clean.

Troubleshooting Steps

If the problem persists,

1. Inspect the wheel encoder sensors and disks for debris.
    - If fouled, clean the sensors and disks, and continue below to validate the repair.
2. Perform the Rear Wheel Encoder check, and correct any errors detected.

5-F47E Start Circle Overlap

Description	The start area overlaps another plan's start area
Fault Name	KNIGHT_COMP_INFO_TRAIN_STARTOVERLAP
Setting Conditions	
When Monitored	Training
Possible Causes	
Initial Action	Retrain the plan with a different starting location.

Additional Information

If two start areas overlap, the scrubber won't know which path to pick when starting autoscrub.

5-F47F Fail No Camera Calib

Description	Failed to record. Camera is not calibrated.
Fault Name	KNIGHT_COMP_INFO_TRAIN_CAMERANOTCALIBRATED
Setting Conditions	Attempting to train without calibrating camera, first.

When Monitored	Training Mode
Possible Causes	Camera calibration is either invalid or missing.
Initial Action	Calibrate camera

5-F480 Fail Set Network

Description	Failed to set QR Code output to file
Fault Name	KNIGHT_COMP_INFO_NET_FAILEDCONFIG
Setting Conditions	Failure when setting QR code
When Monitored	Network Config
Possible Causes	Invalid QR code
Initial Action	Regenerate QR code and show new QR code to Scrubber

5-F481 Fail IP Check

Description	Failed to pass IP checks on string
Fault Name	KNIGHT_COMP_INFO_NET_FAILEDIPCHECK
Setting Conditions	Failed to pass IP checks on string. This is informative to the person who is using the QR code method to established the desired WiFi mode of operation.
When Monitored	Checked when getting the string from the QR code
Possible Causes	Invalid QR Code or a QR code was scanned to intentionally disable the autonomous controller from connecting to an outside WiFi source
Initial Action	Regenerate QR code with a different IP address and show new QR code to the 3D vision sensor.

5-F4A0 Bad 2D Map Sensor Cal

Description	Unused
Fault Name	KNIGHT_COMP_INFO_CALIB_LASERFAIL

5-F4A1 Bad 3D Vision Sens Cal

Description	Failed to determine an accurate position of the camera
Fault Name	KNIGHT_COMP_INFO_CALIB_CAMERAFAIL
Setting Conditions	Failed to determine an accurate position of the camera
When Monitored	Camera Calibration
Possible Causes	Improper calibration procedure
Initial Action	

Troubleshooting Steps

- Make sure the 2D mapping laser is level.
- Make sure the corner that the machine is facing for the calibration procedure is regularly shaped with vertical walls and no variances top to bottom, such as windows or shelves.
- Verify the proper calibration setup, and repeat the calibration.

5-F4A2 Bad Drop-Off Cal

Description	Failed to determine an accurate drop-off threshold
Fault Name	KNIGHT_COMP_INFO_CALIB_DROPOFFFAIL
Setting Conditions	Unable to find Drop-Off Sensor calibration in Autonomy Module
When Monitored	Drop-off calibration
Possible Causes	Uncalibrated Drop-off Sensors
Initial Action	Calibrate Drop-off Sensors

Troubleshooting Steps

Ensure drop off sensors are clean and unobstructed.

5-F4A3 Canceled Cal

Description	Calibration was canceled
Fault Name	KNIGHT_COMP_INFO_CALIB_CANCELED
Setting Conditions	Calibration of drop-off sensors or 3D camera was successfully cancelled
When Monitored	Calibration
Possible Causes	Operator initiated. Normal Operation.
Initial Action	

5-F4A4 Cal Error

Description	An internal logic error occurred during calibration
Fault Name	KNIGHT_COMP_INFO_CALIB_UNKNOWN
Setting Conditions	Unknown or unhandled error when calibrating.
When Monitored	Auto Mode
Possible Causes	Internal error. There was an error calibrating that was not properly classified.
Initial Action	Reboot and calibrate sensor, again.

5-F4A5 3D Sens Calib OK

Description	Calibration for camera set successfully
Fault Name	KNIGHT_COMP_INFO_CALIB_CAMERACALIBOK
Setting Conditions	3D Camera Calibration Successful
When Monitored	When Calibrating
Possible Causes	Normal operation. Informative to the operator.
Initial Action	

5-F4A6 Dropoff Calib OK

Description	Calibration for dropoff set successfully
Fault Name	KNIGHT_COMP_INFO_CALIB_DROPOFFCALIBOK

Setting Conditions	Drop-off Calibration Successful
When Monitored	Drop-off Calibration
Possible Causes	Informative to the operator.
Initial Action	

5-F4A7 2D Map Sensor Cal OK

Description	Calibration for laser set successfully
Fault Name	KNIGHT_COMP_INFO_CALIB_LASERCALIBOK
Setting Conditions	2D Mapping LIDAR calibration successful
When Monitored	Calibration
Possible Causes	Normal Operation. Informative to the operator
Initial Action	

5-F4A8 Camera X Bound Failed

Description	Calibrated too far from corner
Fault Name	KNIGHT_COMP_INFO_CALIB_CAMERAXFAIL
Setting Conditions	3D Camera failed to calibrate
When Monitored	Camera Calibration
Possible Causes	The 3D Camera is mounted too far forward or back
Initial Action	Verify the camera is mounted properly and re-calibrate camera

5-F4A9 Camera Y Bound Failed

Description	Calibration was not lined up with a corner
Fault Name	KNIGHT_COMP_INFO_CALIB_CAMERAYFAIL
Setting Conditions	3D Camera failed to calibrate
When Monitored	Camera Calibration
Possible Causes	The 3D Camera is mounted too far to the left or right
Initial Action	Verify the camera is mounted properly and re-calibrate camera

5-F4AA Camera Z Bound Failed

Description	Calibration was not lined up with a corner
Fault Name	KNIGHT_COMP_INFO_CALIB_CAMERAZFAIL
Setting Conditions	3D Camera failed to calibrate
When Monitored	Camera Calibration
Possible Causes	The 3D Camera is mounted too high or low
Initial Action	Verify the camera is mounted properly and re-calibrate camera

5-F4AB Camera Roll Bound Fail

Description	Calibrated too close to corner
Fault Name	KNIGHT_COMP_INFO_CALIB_CAMERAROLLFAIL
Setting Conditions	3D Camera failed to calibrate
When Monitored	Camera Calibration
Possible Causes	The 3D Camera is tilted too far
Initial Action	Verify the camera is mounted properly and re-calibrate camera

5-F4AC Camera Walls Fail

Description	Calibrated walls not perpendicular
Fault Name	KNIGHT_COMP_INFO_CALIB_CAMERAWALLSNOTPERPENDICULARFAIL
Setting Conditions	The camera calibration routine wasn't able to find 3 walls perpendicular to each other.
When Monitored	Camera Calibration
Possible Causes	The camera isn't calibrating to a corner or can't find the corner.
Initial Action	Move to a corner and calibrate camera, again.

5-F4B0 No DropOff Detection

Description	The Safety Board’s drop-off detection is disabled
Fault Name	KNIGHT_COMP_INFO_HEALTH_DROPOFFDETECTIONDISABLED
Setting Conditions	The system is autoscrubbing with drop-off detection disabled.
When Monitored	Auto Mode
Possible Causes	The Operator intentionally disabled drop-off detection.
Initial Action	Normal Operation

5-F4B1 Compute No Memory

Description	The Compute Board has run out of available memory
Fault Name	KNIGHT_COMP_INFO_HEALTH_OUTOFMEMORY
Setting Conditions	Memory on the scrubber exceeds the 90% threshold
When Monitored	Always
Possible Causes	Scrubber in operation too long
Initial Action	Reboot Scrubber

5-F4B3 Degraded

Description	The scrubber has entered a degraded state
Fault Name	KNIGHT_COMP_INFO_HEALTH_DEGRADED
Setting Conditions	The scrubber is in a state that requires a reboot. Either software updated or out of memory. The scrubber won’t auto-scrub
When Monitored	Always

Possible Causes	Various causes. See other EMCY codes.
Initial Action	Reboot Scrubber

5-F4B5 No 2D Map Sensor Conn

Description	The Autonomy Kit has failed to make a connection with the Mapping Sensors
Fault Name	KNIGHT_COMP_INFO_HEALTH_NOLASERCONN
Setting Conditions	Neither Ethernet nor sync (power cable) data connections detected.
When Monitored	Always
Possible Causes	Mapping LIDAR power cable disconnected or Mapping LIDAR module faulty
Initial Action	

Troubleshooting Steps

1. Disconnect and re-seat the power cable between the autonomous module and the laser.
    - If the indicator lights illuminate, reboot the system to validate the repair.
2. Disconnect the power cable at the laser module.
3. Check the voltage between pins 1 and 3 of the power cable (upper image).
    - If the voltage is at or near 24 volts, replace the laser module.
4. Disconnect the power cable from the autonomous module.
5. Check the voltage between pins 1 and 3 of the autonomous module (lower image).
    - If the voltage is at or near 24 volts, replace the power cable.
    - If the voltage is not 24 volts, replace the autonomous module.

5-F4B6 No Pattern Projector

Description	The Autonomy Kit has failed to turn on the pattern projector
Fault Name	KNIGHT_COMP_INFO_HEALTH_NOPATRNPROJ
Setting Conditions	The pattern projector does not appear to be turning on when commanded.
When Monitored	Auto Mode
Possible Causes	Faulty pattern projector.
Initial Action	Reboot the Machine

Troubleshooting Steps

Check to make sure the pattern projector is properly connected to the front of the 3D camera. If the error persists, replace the camera/projector.

5-F4B9 MMC Vers Incompatable

Description	The MMC has an incompatible version of firmware loaded.
Fault Name	KNIGHT_COMP_INFO_HEALTH_CLEANBRDVERSION
Setting Conditions	MMC is not up-to-date
When Monitored	Bootup
Possible Causes	
Initial Action	Update the MMC firmware

5-F4C4 Front Left Drop-Off

Description	Front left Drop-Off Sensor detected
Fault Name	KNIGHT_COMP_INFO_AUTOSAFETY_DROPOFFFRONTLEFT
Setting Conditions	Front left drop-off sensor value is greater than 10 cm from the floor
When Monitored	Auto Mode
Possible Causes	There is a drop-off or ledge near the scrubber
Initial Action	

Troubleshooting Steps

If the problem persists, calibrate the drop-off sensor.

5-F4C5 Front Rt Drop-Off

Description	Front right Drop-Off Sensor detected
Fault Name	KNIGHT_COMP_INFO_AUTOSAFETY_DROPOFFFRONTRIGHT
Setting Conditions	Front right drop-off sensor value is greater than 10 cm from the floor
When Monitored	Auto Mode
Possible Causes	There is a drop-off or ledge near the scrubber
Initial Action	

Troubleshooting Steps

If the problem persists, calibrate the drop-off sensor.

5-F4C6 Left Side Drop-Off

Description	Left side Drop-Off Sensor detected
Fault Name	KNIGHT_COMP_INFO_AUTOSAFETY_DROPOFFSIDELEFT
Setting Conditions	Side left drop-off sensor value is greater than 10 cm from the floor
When Monitored	Auto Mode
Possible Causes	There is a drop-off or ledge near the scrubber

Initial Action	

Troubleshooting Steps

If the problem persists, calibrate the drop-off sensor.

5-F4C7 Right Side Drop-Off

Description	Right side Drop-Off Sensor detected
Fault Name	KNIGHT_COMP_INFO_AUTOSAFETY_DROPOFFSIDERIGHT
Setting Conditions	Side right drop-off sensor value is greater than 10 cm from the floor
When Monitored	Auto Mode
Possible Causes	There is a drop-off or ledge near the scrubber
Initial Action	

Troubleshooting Steps

If the problem persists, calibrate the drop-off sensor.

5-F4C9 Front Proximity

Description	No Longer Used
Fault Name	KNIGHT_COMP_INFO_AUTOSAFETY_PROXIMITYFRONT

5-F4CA Left Safety Sens Obs

Description	Left Safety Sensor error or safety sensor sees an obstacle.
Fault Name	KNIGHT_COMP_INFO_AUTOSAFETY_PROXIMITYLEFT
Setting Conditions	Left Safety LIDAR tripped for an obstacle
When Monitored	Auto Mode
Possible Causes	Obstacle near scrubber
Initial Action	

Troubleshooting Steps

If problem persists, retrain path.

5-F4CB Right Safety Sens Obs

Description	Right Safety Sensor error or safety sensor sees an obstacle.
Fault Name	KNIGHT_COMP_INFO_AUTOSAFETY_PROXIMITYRIGHT
Setting Conditions	Right Safety LIDAR tripped for an obstacle
When Monitored	Auto Mode
Possible Causes	Obstacle near scrubber
Initial Action	

Troubleshooting Steps

If problem persists, retrain path.

5-F4DB Lost Path

Description	Auto-scrub unable to continue, lost path
Fault Name	KNIGHT_COMP_INFO_AUTO2_LOSTPATH
Setting Conditions	The Autonomy kit stopped getting path information
When Monitored	Auto Mode
Possible Causes	Software issue internal to the autonomy software
Initial Action	Restart plan

5-F510 Autonomy Boot Error

Description	Compute Board was unable to boot successfully
Fault Name	KNIGHT_COMP_WARN_BOOT_FAILED
Setting Conditions	Autonomy Module had a generic boot failure
When Monitored	Bootup
Possible Causes	See Other EMCY Codes
Initial Action	

Troubleshooting Steps

The autonomy software is not operational. See other EMCY codes to troubleshoot what cause the autonomy software to not boot properly.

5-F511 Autonomy Updated

Description	The Platform Board firmware inconsistent with Compute Board
Fault Name	KNIGHT_COMP_WARN_BOOT_EMBEDDEDIMAGE
Setting Conditions	Incorrect Platform Board software version detected
When Monitored	Bootup
Possible Causes	New Autonomy software
Initial Action	Autonomy software is finishing updates. After the update completes. Reboot the scrubber.

5-F513 Unused in FL

Description	Unused
Fault Name	KNIGHT_COMP_WARN_BOOT_LASERCALIB

5-F514 No 3D Vision Sens Cal

Description	Valid 3D Vision Sensor calibration data was not found during boot
Fault Name	KNIGHT_COMP_WARN_BOOT_CAMERACALIB
Setting Conditions	Autonomy Module does not know the position of the 3D Camera relative to the 2D mapping laser.
When Monitored	Bootup

Possible Causes	3D Camera not calibrated
Initial Action	Calibrate 3D Camera

5-F515 Drop-Off Cal

Description	Valid Drop-Off Sensor calibration data was not found during boot
Fault Name	KNIGHT_COMP_WARN_BOOT_DROPOFFCALIB
Setting Conditions	Autonomy Module does not know the position of the drop-off sensor relative to the floor
When Monitored	Bootup
Possible Causes	Drop-off sensor not calibrated
Initial Action	Calibrate Drop-off sensors

5-F51E Boot Timeout

Description	A timeout occurred while waiting for SDO requests.
Fault Name	KNIGHT_COMP_WARN_BOOT_SDOTIMEOUT
Setting Conditions	Autonomy module is not able to communicate with the MMC
When Monitored	Bootup
Possible Causes	Incorrect CAN Node ID Configuration
Initial Action	

Troubleshooting Steps

Check that the CAN ID in Configuration Menu on the MMC is set appropriately.

5-F51F LIDAR Boot

Description	A timeout occurred while waiting for Laser Scanner Info.
Fault Name	KNIGHT_COMP_WARN_BOOT_LASERTIMEOUT
Setting Conditions	Unable to communicate with the 2D Mapping LIDAR
When Monitored	Bootup
Possible Causes	Mapping laser defective or cabling issues
Initial Action	Check cabling to mapping laser

5-F524 Unknown Tag

Description	Trying to delete next tag but it is not known location tag
Fault Name	KNIGHT_COMP_WARN_HOMING_UNKNOWNTAG
Setting Conditions	The current location tag in front of the scrubber has not been previously set as a home position
When Monitored	Tag Deleteion
Possible Causes	Looking at an unknown location tag
Initial Action	None, normal operation. Tag to delete has already been deleted.

5-F530 Update Not Ready

Description	No longer used
Fault Name	KNIGHT_COMP_WARN_UPDATE_NOTREADY

5-F559 MMC Exit

Description	MMC bad exit of auto
Fault Name	KNIGHT_COMP_WARN_AUTO_INVADER
Setting Conditions	The main machine controller exited auto-scrub
When Monitored	Auto Mode
Possible Causes	The main machine controller detected a failure and exited out of auto-scrub
Initial Action	See additional fault codes

5-F591 Fail Delete File

Description	Error deleting file
Fault Name	KNIGHT_COMP_WARN_SERVICE_FAILEDPURGE
Setting Conditions	Unable to delete a file on the file system
When Monitored	Auto Mode
Possible Causes	File system inconsistency or software error. Multiple hard power cycles of the Autonomy module causing file system corruption.
Initial Action	Reboot the machine

5-F5B2 Storage Drive Fail

Description	Unable to write to Storage Drive
Fault Name	KNIGHT_COMP_WARN_HEALTH_SDCARDWRITEFAILED
Setting Conditions	Unable to write a file to the Storage Drive
When Monitored	Auto Mode
Possible Causes	System was left on for a long period of time and ran out of disk space
Initial Action	Reboot the machine to clear out space.

5-F5B4 No Obstacle Detect

Description	Laser and 3D Vision Sensor obstacle detection is disabled
Fault Name	KNIGHT_COMP_WARN_HEALTH_NOOBSTACLEDETECTION
Setting Conditions	This should only be seen during safety certification. The Scrubber is running in a state where it ignores 3D Camera and Mapping LIDAR obstacles. It is used to verify operation of the Safety LIDAR.
When Monitored	Auto Mode
Possible Causes	

Initial Action	Perform Safety Certification Testing then reboot the system

5-F5B7 L Safety Sens Assy

Description	The Autonomy Kit has determined there is a problem with the rotation of left Safety Sensor
Fault Name	KNIGHT_COMP_WARN_HEALTH_SAFETYLASERASSYL
Setting Conditions	The Autonomy Kit has determined there is a problem with the position of the left safety LIDAR, and cannot enter auto mode.
When Monitored	Always
Possible Causes	The safety LIDAR has been moved, jostled, or misadjusted.
Initial Action	

Troubleshooting Steps

Perform the Safety Sensor Rotational Position Check (Right and Left)

5-F5B8 R Safety Sens Assy

Description	The Autonomy Kit has determined there is a problem with the rotation of right Safety Sensor
Fault Name	KNIGHT_COMP_WARN_HEALTH_SAFETYLASERASSYR
Setting Conditions	The Autonomy Kit has determined there is a problem with the position of the right safety LIDAR, and cannot enter auto mode.
When Monitored	Always
Possible Causes	The safety LIDAR has been moved, jostled, or misadjusted.
Initial Action	

Troubleshooting Steps

Perform the Safety Sensor Rotational Position Check (Right and Left)

5-F5BA L Safety Sensor Conn

Description	Left Laser has a hardware connection fault in OSSD lines 1 and 2
Fault Name	KNIGHT_COMP_WARN_HEALTH_LSAFETYLASEROSSDMISMATCH
Setting Conditions	Left Safety LIDAR has a hardware connection fault in OSSD lines 1 and 2
When Monitored	Always
Possible Causes	Broken or Damaged Cabling between the safety LIDAR and breakout box.
Initial Action	Troubleshoot cabling

5-F5BB R Safety Sensor Conn

Description	Right Laser has a hardware connection fault in OSSD lines 1 and 2
Fault Name	KNIGHT_COMP_WARN_HEALTH_RSAFETYLASEROSSDMISMATCH
Setting Conditions	Right Laser has a hardware connection fault in OSSD lines 1 and 2

When Monitored	Always
Possible Causes	Broken or Damaged Cabling between the safety LIDAR and breakout box.
Initial Action	Troubleshoot cabling

5-F5BC Pltfrm interface abs

Description	Platform interface on compute is not responding with right IP
Fault Name	KNIGHT_COMP_WARN_HEALTH_PLTFRMUNCONNECTED
Setting Conditions	An Ethernet link internal in the autonomy kit went down.
When Monitored	Always
Possible Causes	Internal electrical malfunction
Initial Action	Internal error. Reboot the machine. If the error persists, contact Nilfisk Technical Support for authorization to replace the autonomous module.

Troubleshooting Steps

5-F5BD Multisns intrfc abs

Description	Multisense interface on compute is not responding correct IP
Fault Name	KNIGHT_COMP_WARN_HEALTH_CAMERAUNCONNECTED
Setting Conditions	3D Camera Ethernet connection link went down
When Monitored	Always
Possible Causes	Loose cable to 3D camera
Initial Action	Check cabling to the 3D camera

Troubleshooting Steps

If the problem persists, replace 3D Camera.

5-F5BE No Platform Sync Pulse

Description	The Platform board lost a sync pulse
Fault Name	KNIGHT_COMP_WARN_HEALTH_NOPLATFORMSYNCPULSE
Setting Conditions	The Autonomy module is not getting platform sync pulses from the platform board.
When Monitored	Auto Mode
Possible Causes	Either the Mapping LIDAR is not sending platform sync pulses, or the autonomy module is not able to receive them.
Initial Action	Check Mapping LIDAR and connections. Replace either Mapping LIDAR, cabling, or autonomy modules if problem persists.

Troubleshooting Steps

Note: You may occasionally see this if the connection is intermittent. Verify cables are tightened if this appears after

running for a while.

5-F5C3 Safety Drop-Off

Description	General Drop-Off Sensor error
Fault Name	KNIGHT_COMP_WARN_AUTOSAFETY_DROPOFF
Setting Conditions	Scrubber detected an unsafe condition for the Drop-Off Sensors. Disconnected, Uncalibrated, or not functioning.
When Monitored	Bootup
Possible Causes	Failed drop-off sensor
Initial Action	Check that drop-off sensors are powered on and connected

5-F5C8 Gen Safety Sens Err

Description	General safety sensor error.
Fault Name	KNIGHT_COMP_WARN_AUTOSAFETY_PROXIMITY
Setting Conditions	Both Safety LIDARs are unsafe
When Monitored	Auto Mode
Possible Causes	Malfunctioning safety LIDARs. Obstacle detected by both safety LIDARS.
Initial Action	If there is an obstacle, move the obstacle.

Troubleshooting Steps

If the error persists, look at the 2 digit code on the safety LIDAR display. Consult the Hokuyo UAM Manual to determine the next steps.

5-F5D9 Auto Exit Safety Sens

Description	The Autonomy Kit could not go into auto scrub because of a bad assembly of one or more of the Safety Sensors.
Fault Name	KNIGHT_COMP_WARN_AUTO2_AUTOEXITSAFETYLASERASSY
Setting Conditions	A Safety LIDAR has a bad assembly, or has deviated too far from its optimal position, and the robot attempted to enter auto.
When Monitored	Auto Mode
Possible Causes	Safety LIDAR shifted during operation.
Initial Action	Check the safety laser rotation position adjustments.

5-F5DC Safety Sensor OSSD

Description	Kickout as Safety Sensors have an OSSD mismatch
Fault Name	KNIGHT_COMP_WARN_AUTO2_AUTOEXITSAFETYLASEROSSDMISMATCH
Setting Conditions	The redundant OSSD lines to the safety sensor don't match.
When Monitored	Auto Mode
Possible Causes	Faulty connection/cable between the safety sensor and the Autonomy module. Faulty safety

	sensor.
Initial Action	Inspect cables and connections.

5-F5E0 No 3D Vision Sens Conn

Description	The Autonomy Kit has failed to make a connection with the 3D Vision Sensor
Fault Name	KNIGHT_COMP_WARN_CAMERA_NOCAMERACONN
Setting Conditions	There was a problem connecting to the stereo camera
When Monitored	Always
Possible Causes	The 3D Camera software is old. 3D Camera is not properly configured.
Initial Action	Replace cabling to camera or 3D Camera

5-F5E1 3D Sens General Err

Description	There was a general camera error.
Fault Name	KNIGHT_COMP_WARN_CAMERA_GENCAMERROR
Setting Conditions	3D Camera detected an unknown errorobstacle in the way
When Monitored	Always
Possible Causes	Generic unclassified error for the 3D Camera sensor
Initial Action	Look at other EMCY codes to determine root cause of error.

5-F5E2 3D Sens Lght Conf Null

Description	3D Vision Sensor lighting config was null.
Fault Name	KNIGHT_COMP_WARN_CAMERA_LIGHTCFGNULL
Setting Conditions	3D Camera doesn't have a pattern projector
When Monitored	Bootup
Possible Causes	The 3D Camera doesn't have a pattern projector.
Initial Action	Replace camera with one that has a pattern projector

5-F5E3 3D Sens Img Calib Null

Description	3D Vision Sensor image calibration was null.
Fault Name	KNIGHT_COMP_WARN_CAMERA_IMGCALNULL
Setting Conditions	3D Camera has an incorrect Image Calibration
When Monitored	Bootup
Possible Causes	The 3D Camera hasn't been calibrated.
Initial Action	Replace Camera

5-F5E4 3D Sens Img Conf Null

Description	3D Vision Sensor image configuration was null.
Fault Name	KNIGHT_COMP_WARN_CAMERA_IMGCFGNULL

Setting Conditions	3D Camera has an incorrect Image Calibration
When Monitored	Bootup
Possible Causes	The 3D Camera hasn't been calibrated.
Initial Action	Replace Camera

5-F5E5 3D Sens Dev Info Null

Description	3D Vision Sensor device info was null.
Fault Name	KNIGHT_COMP_WARN_CAMERA_DEVINFONULL
Setting Conditions	3D Camera is missing device information
When Monitored	Bootup
Possible Causes	The 3D Camera hasn't been calibrated.
Initial Action	Replace Camera

5-F5E6 Timeout 3D Sens Status

Description	3D Vision Sensor connection timed out.
Fault Name	KNIGHT_COMP_WARN_CAMERA_TIMEDOUT
Setting Conditions	Timed out trying to connect to the 3D Camera
When Monitored	Bootup
Possible Causes	The 3D Camera isn't connected or isn't properly configured.
Initial Action	Check cabling or replace camera.

5-F5E7 Error 3D Sens Status

Description	3D Vision Sensor connection experienced an error.
Fault Name	KNIGHT_COMP_WARN_CAMERA_ERROR
Setting Conditions	3D Camera has a generic error
When Monitored	Bootup
Possible Causes	The 3D Camera is malfunctioning or misconfigured.
Initial Action	Replace Camera

5-F5E8 Failed 3D Sens Status

Description	3D Vision Sensor connection failed.
Fault Name	KNIGHT_COMP_WARN_CAMERA_FAILED
Setting Conditions	Failed to perform an operation on the camera
When Monitored	Bootup
Possible Causes	The 3D Camera is malfunctioning
Initial Action	Replace Camera

5-F5E9 Unsupported 3D Status

Description	3D Vision Sensor connection unsupported.
Fault Name	KNIGHT_COMP_WARN_CAMERA_UNSUPPORTED
Setting Conditions	3D Camera does not support an operation
When Monitored	Bootup
Possible Causes	The 3D Camera software is too old.
Initial Action	Replace Camera

5-F5EA Unknown 3D Sens Status

Description	3D Vision Sensor connection unknown.
Fault Name	KNIGHT_COMP_WARN_CAMERA_UNKNOWN
Setting Conditions	3D Camera has an unknown error
When Monitored	Bootup
Possible Causes	The 3D Camera hasn't been configured or is malfunctioning
Initial Action	Replace Camera

5-F5EB 3D Sens Exception

Description	3D Vision Sensor connection experienced an exception.
Fault Name	KNIGHT_COMP_WARN_CAMERA_EXCEPTION
Setting Conditions	Software interacting with the 3D Camera had an unhandled exception
When Monitored	Bootup
Possible Causes	Software issue
Initial Action	Reboot Scrubber

5-F5EC 3D Sens Undef Status

Description	3D Vision Sensor connection undefined.
Fault Name	KNIGHT_COMP_WARN_CAMERA_UNDEFINED
Setting Conditions	3D Camera has an error that isn't defined in software
When Monitored	Bootup
Possible Causes	Software Issue
Initial Action	Reboot scrubber or Replace Camera

5-F5F0 Boot Timeout

Description	A timeout occurred while waiting for 3D Vision Sensor Info.
Fault Name	KNIGHT_COMP_WARN_BOOT2_CAMTIMEOUT
Setting Conditions	Autonomy Module took longer than 30 seconds to complete a step communicating with the camera in the boot-up procedure
When	Bootup

Monitored	
Possible Causes	Malfunctioning Camera or faulty cables
Initial Action	Check cabling to camera.

5-F5F4 No MMC Image

Description	No MMC image is available in the embedded directory.
Fault Name	KNIGHT_COMP_WARN_BOOT2_NOINVADERBOARD
Setting Conditions	Autonomy Module did not have an embedded update image for the MMC.
When Monitored	Bootup
Possible Causes	The scrubber is running with development software.
Initial Action	Update Software

5-F5F5 Boot Timeout

Description	A timeout occurred while waiting for Plans to load.
Fault Name	KNIGHT_COMP_WARN_BOOT2_PLANSTIMEOUT
Setting Conditions	A timeout occurred while waiting for Plans to load.
When Monitored	Bootup
Possible Causes	There are too many plans trained.
Initial Action	Delete some plans.

5-F612 Boot Timeout

Description	A timeout occurred while waiting for a component of the boot process
Fault Name	KNIGHT_COMP_ERR_BOOT_TIMEOUT
Setting Conditions	Autonomy Module took longer than 30 seconds to complete a step in the boot-up procedure
When Monitored	Auto Mode
Possible Causes	Check for other EMCY Codes to determine what caused the system to take a while to boot
Initial Action	

5-F616 Bad Map Position

Description	Unused
Fault Name	KNIGHT_COMP_ERR_BOOT_MAPPINGSTATE

5-F617 Database Corrupted

Description	A persistence database is corrupted on the Storage Drive
Fault Name	KNIGHT_COMP_ERR_BOOT_DBCORRUPT
Setting Conditions	File on Storage Drive is corrupted. Data is lost
When	Boot

Monitored	
Possible Causes	File system inconsistency or software error. Multiple hard power cycles of the Autonomy module causing file system corruption.
Initial Action	Reboot the machine. If the error persists, contact Nilfisk Technical Support forauthorization to replace the autonomous module.

5-F618 File Corrupted

Description	A file access problem with the database
Fault Name	KNIGHT_COMP_ERR_BOOT_DBACCESS
Setting Conditions	Failure trying to remove a database file.
When Monitored	Always
Possible Causes	File system corrupted
Initial Action	Reboot system to run automatic file system repair

5-F619 Boot Image

Description	Attempt to remedy inconsistent embedded board version has failed
Fault Name	KNIGHT_COMP_ERR_BOOT_EMBEDDEDUPDATE
Setting Conditions	Failed attempt to update Platform and Compute Boards inside Autonomy Module
When Monitored	Bootup
Possible Causes	Internal Error
Initial Action	If reboot fails, replace autonomy module

5-F61A Unsupported Plat Board

Description	Platform Board is deprecated. Or autonomy software is too old.
Fault Name	KNIGHT_COMP_ERR_BOOT_BOARDNOTSUPPORTED
Setting Conditions	The hardware revision of the Platform Board is not supported
When Monitored	Bootup
Possible Causes	Old Hardware
Initial Action	Upgrade Autonomy module

5-F61B No Platform Version

Description	Could not read version of the board in Platform Box
Fault Name	KNIGHT_COMP_ERR_BOOT_BOARDNOHASH
Setting Conditions	Unable to get version information from Platform Board or Safety Board
When Monitored	Bootup
Possible Causes	Incorrect software loaded onto the platform or safety boards
Initial Action	If reboot fails, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-F61D Boot Timeout

Description	A timeout occurred while waiting for Platform Board and Safety Board to boot.
Fault Name	KNIGHT_COMP_ERR_BOOT_PLATFORMTIMEOUT
Setting Conditions	Autonomy Module waited more than 30 seconds to communicate with the platform or safety board in the boot-up procedure
When Monitored	Bootup
Possible Causes	Internal Error
Initial Action	Manually update software to update platform board

5-F623 Permanently Lost

Description	Unused
Fault Name	KNIGHT_COMP_ERR_HOMING_PERMLOST

5-F625 Orphaned Plan

Description	A plan exists, not associated with known home
Fault Name	KNIGHT_COMP_ERR_HOMING_ORPHANPLAN
Setting Conditions	A plan was found that does not have a home tag
When Monitored	Bootup
Possible Causes	Internal Software bug
Initial Action	Retrain Plan

Troubleshooting Steps

A safe plan on the system was lost because the Location Tag data associated with that plan was either deleted or corrupted.

5-F632 Update Timeout

Description	Timeout occurred during update download or installation
Fault Name	KNIGHT_COMP_ERR_UPDATE_TIMEOUT
Setting Conditions	TCP/IP Wi-Fi connection to the internet timed out
When Monitored	Software Update
Possible Causes	Bad Wi-Fi signal
Initial Action	Move to area with better cell or Wifi signal

5-F634 Bad Update Install

Description	The update was not known to install correctly
Fault Name	KNIGHT_COMP_ERR_UPDATE_NOINSTALL
Setting Conditions	The software update had an internal failure
When Monitored	During Update

Possible Causes	Software error
Initial Action	Repeat update installation

5-F635 Update Timeout

Description	Timeout occurred during update download or installation
Fault Name	KNIGHT_COMP_ERR_UPDATE_CHECKAPITIMEOUT
Setting Conditions	System timed out attempting to contact the update server
When Monitored	System Upgrade
Possible Causes	Lost internet connection
Initial Action	Move to area with better internet connection

5-F636 Update Timeout

Description	Timeout occurred during update download or installation
Fault Name	KNIGHT_COMP_ERR_UPDATE_DOWNLOADTIMEOUT
Setting Conditions	System timed out trying to download the update.
When Monitored	System Upgrade
Possible Causes	Poor wifi or cell signal
Initial Action	Move to better wifi or an area with a better cell signal before trying the upgrade again.

5-F637 Update Timeout

Description	Timeout occurred during update download or installation
Fault Name	KNIGHT_COMP_ERR_UPDATE_CHECKVERMETATIMEOUT
Setting Conditions	System timed out trying to check the metadata for the upgrade
When Monitored	System Upgrade
Possible Causes	Corrupt or incomplete metadata file
Initial Action	Reboot system and reattempt the installation

5-F638 Update Timeout

Description	Timeout occurred during update download or installation
Fault Name	KNIGHT_COMP_ERR_UPDATE_CHECKVERTARTIMEOUT
Setting Conditions	The system timed out waiting to check the install for a version
When Monitored	System Upgrade
Possible Causes	Corrupt upgrade file
Initial Action	Reboot scrubber and reattempt upgrade

5-F639 Update Timeout

Description	Timeout occurred during update download or installation
Fault Name	KNIGHT_COMP_ERR_UPDATE_STARTINSTALLTIMEOUT

Setting Conditions	The system attempted to install an update but timed out trying to star the install
When Monitored	Installing Update
Possible Causes	Software error
Initial Action	Reboot system and retry the install

5-F640 Unknown Drive Space

Description	Logging was not able to transit to save state due to unknown free space on Storage Drive
Fault Name	KNIGHT_COMP_ERR_LOG_UNKNOWNSPACE
Setting Conditions	Unable to determine how much free space is on Storage Drive.
When Monitored	Always
Possible Causes	Lack of memory space or malfunction in Storage Drive
Initial Action	If reboot fails, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-F641 No Storage Space

Description	There is not any space available on the Storage Drive
Fault Name	KNIGHT_COMP_ERR_LOG_NOSPACE
Setting Conditions	No disk space left to log data
When Monitored	Auto Mode
Possible Causes	Software error
Initial Action	Reboot scrubber

Troubleshooting Steps

Note some log data and reporting information may be lost.

5-F642 Delete Log File

Description	Failed to delete a log file
Fault Name	KNIGHT_COMP_ERR_LOG_FAILEDDELETE
Setting Conditions	Unable to delete an old file on the file system
When Monitored	Always
Possible Causes	File system inconsistency or software error
Initial Action	If reboot fails, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-F643 Error Save Log

Description	An error occurred when saving last log session to Storage Drive
Fault Name	KNIGHT_COMP_ERR_LOG_FAILEDSAVE
Setting	Failed to store log to the storage drive. Software internal to the Autonomy Module had a

Conditions	problem
When Monitored	Always
Possible Causes	Autonomy Module Internal Error
Initial Action	If reboot fails, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-F646 Log Purge Fail

Description	Unused
Fault Name	KNIGHT_COMP_ERR_LOG_FAILEDCLEAR

5-F650 No 3D Vision Sens Data

Description	Auto-scrub unable to continue, scrubber not receiving valid 3D data from the camera
Fault Name	KNIGHT_COMP_ERR_AUTO_NODISPARITY
Setting Conditions	Camera software error. Autonomy Module not seeing depth data from 3D Camera
When Monitored	Auto Mode
Possible Causes	Dirty or Faulty Stereo Camera
Initial Action	Clean Camera

5-F651 2D Map Sensor Comm

Description	Auto-scrub unable to continue, scrubber not receiving valid laser scan data
Fault Name	KNIGHT_COMP_ERR_AUTO_NOLASERSCAN
Setting Conditions	Autonomy Module did not see Mapping Laser data for 250 ms
When Monitored	Auto Mode
Possible Causes	Bad data cable or bad laser module.
Initial Action	Make sure data cable is tight.

Troubleshooting Steps

1. Inspect the Ethernet cable for damage, bent pins, and ensure the cable is firmly connected to both modules.
2. Swap out the Ethernet cable with a known good cable.
3. If a known good cable is not readily available, check continuity pin- to-pin of the cable according to the pinouts shown to the lower image.
4. If the cable has been eliminated as the cause, replace the laser module.

5-F653 Deck Not Changing

Description	The height of deck is not changing as requested
Fault Name	KNIGHT_COMP_ERR_AUTO_SCRUBDECK
Setting Conditions	Autonomy Module timed out after 12 seconds waiting for the scrub deck height to change
When Monitored	Auto Mode
Possible Causes	Malfunctioning Scrubdeck
Initial Action	Check the main controller for any error codes, and troubleshoot those.

5-F657 Cannot Move

Description	Auto-scrub unable to continue, traction commands do not have consistent encoder data
Fault Name	KNIGHT_COMP_ERR_AUTO_TRACCONSIST
Setting Conditions	Commanded traction travel to the Main controller does not match wheel encoder input.
When Monitored	Auto Mode
Possible Causes	Faulty wheel encoders. Scrubber ran into or over an obstacle.
Initial Action	If traction drive error codes exist, troubleshoot those first.

Troubleshooting Steps

1. Inspect the wheel encoder sensors and disks for debris.
    - If fouled, clean the sensors and disks, and continue below to validate the repair.
2. Perform the Rear Wheel Encoders described on page 140, and correct any errors detected.

5-F658 Auto-Scrub Exit

Description	Auto-scrub unable to continue, unspecified reason
Fault Name	KNIGHT_COMP_ERR_AUTO_UNSPECIFIED
Setting Conditions	A kickout of autoscrub without a specified reason
When Monitored	Auto Mode
Possible Causes	Software issue. The reason for the kickout was not properly added.
Initial Action	Resume Plan

5-F660 Failed Load Plan

Description	One or more plans could not be loaded from database
Fault Name	KNIGHT_COMP_ERR_PLAN_LOADFAIL
Setting Conditions	Failure to load a plan from the database on Autonomy Module
When Monitored	Bootup
Possible Causes	Internal Software error. Plan newer than software.
Initial Action	Continue to operate scrubber normal.

Troubleshooting Steps

This can happen if a plan was recorded on a newer version of software and afterword the software was downgraded.

5-F661 Fail Create Plan

Description	Failed to generate or load plan
Fault Name	KNIGHT_COMP_ERR_PLAN_LOADTIMEOUT
Setting Conditions	Autonomy Module failed to load the plan in time
When Monitored	Auto Mode
Possible Causes	Internal Error
Initial Action	Delete plan and create a new one.

Troubleshooting Steps

If a plan is causing this problem, it encountered a bug in the plan generation algorithm. As a work around, train the plan again.

5-F663 Safe Area Gen Failed

Description	Unused
Fault Name	KNIGHT_COMP_ERR_PLAN_FAILSAFEAREAGEN

5-F664 Probability Grid Gen Failed

Description	Failed to generate probability grid
Fault Name	KNIGHT_COMP_ERR_PLAN_FAILPROBGRIDGEN
Setting Conditions	Failed to generate probability grid map. The Probability map is the map of the walls seen when the plan was recorded.
When Monitored	Auto Mode
Possible Causes	Internal error
Initial Action	Retrain Plan

5-F671 Failed Save Plan

Description	Failed to save the plan
Fault Name	KNIGHT_COMP_ERR_TRAIN_FAILED
Setting Conditions	Autonomy module encountered a generic error training the plan
When Monitored	Training
Possible Causes	Internal Software Issue
Initial Action	Retrain Plan

5-F672 Save Plan Timeout

Description	The saved state timed out
Fault Name	KNIGHT_COMP_ERR_TRAIN_TIMEOUT
Setting Conditions	Autonomy Module timed out saving the plan
When Monitored	Training
Possible Causes	Plan Too Large or software issue
Initial Action	Retrain Plan

5-F673 Fail End Recording

Description	Failed when ending recording
Fault Name	KNIGHT_COMP_ERR_TRAIN_STOPFAIL
Setting Conditions	Attempting to finish a plan that doesn’t exist or failed to end the plan. Communication mismatch between the main

controller and Autonomy

Module	
When Monitored	Auto Mode
Possible Causes	Autonomy Communication Error
Initial Action	Reboot scrubber, retrain plan

5-F677 Cancel Recording Fail

Description	A failure occurred while canceling recording
Fault Name	KNIGHT_COMP_ERR_TRAIN_CANCELFAIL
Setting Conditions	Main controller attempted to cancel training, but the scrubber wasn’t training
When Monitored	Always
Possible Causes	Version incompatibility between main controller and Autonomy Module
Initial Action	Update main controller firmware

5-F692 MMC Comm

Description	Invader sent a bad command to the MMC
Fault Name	KNIGHT_COMP_ERR_SERVICE_NOTACOMMAND
Setting Conditions	Autonomy Module got an unknown command from main controller
When Monitored	Always
Possible Causes	Version incompatibility between main controller and Autonomy Module
Initial Action	

5-F693 MMC Object

Description	Invader sent a bad object information to the MMC
Fault Name	KNIGHT_COMP_ERR_SERVICE_NOTANOBJECT
Setting Conditions	Autonomy Module got a CANBus SDO command with unexpected data
When Monitored	Always
Possible Causes	Version incompatibility between main controller and Autonomy Module
Initial Action	Update firmware for main controller and autonomy module

5-F694 No SDO Data

Description	The SDO did not contain any data
Fault Name	KNIGHT_COMP_ERR_SERVICE_NODATA
Setting Conditions	Autonomy Module got an SDO command with unexpected data
When Monitored	Always
Possible Causes	Version incompatibility between main controller and Autonomy Module
Initial Action	Update firmware for main controller and autonomy module

5-F695 Got 2 SDOs

Description	Received another SDO before finishing
Fault Name	KNIGHT_COMP_ERR_SERVICE_UNEXPECTEDREQ
Setting Conditions	Autonomy Module got an SDO command with unexpected data
When Monitored	Always
Possible Causes	Version incompatibility between main controller and Autonomy Module
Initial Action	Update firmware for main controller and autonomy module

5-F696 Wrong Toggle Bit

Description	Received the wrong toggle bit
Fault Name	KNIGHT_COMP_ERR_SERVICE_WRONGTOGGLE
Setting Conditions	Autonomy Module got invalid toggle bit from main controller
When Monitored	Always
Possible Causes	Version incompatibility between main controller and Autonomy Module
Initial Action	Update firmware for main controller and autonomy module

5-F6C0 Safety Backward

Description	The scrubber moved backward during auto-scrub
Fault Name	KNIGHT_COMP_ERR_AUTOSAFETY_BACKWARDMOTION
Setting Conditions	Autonomy Module exited auto-scrub because of an unsafe condition
When Monitored	Auto Mode
Possible Causes	Drive controller error. Front Brake not on. Driving up steep ramp.
Initial Action	Don't train on a ramp. Make sure the front brake is on.

Troubleshooting Steps

If the error was reported while the machine was actually moving forward, perform the Rear Wheel Encoders Check and correct any errors detected.

5-F6C1 Safety Battery

Description	Bad battery voltage detected
Fault Name	KNIGHT_COMP_ERR_AUTOSAFETY_BATTERYVOLTAGE
Setting Conditions	Autonomy Module exited auto-scrub because of an unsafe battery condition. The battery voltage dropped below 19 volts.
When Monitored	Auto Mode
Possible Causes	
Initial Action	See accompanying error codes.

Troubleshooting Steps

Refer to the troubleshooting steps for 5-3000 Low Battery Voltage.

5-F6C2 Safety Config

Description	The Safety Board needs configuration
Fault Name	KNIGHT_COMP_ERR_AUTOSAFETY_CONFIGURATION
Setting Conditions	The safety board doesn't have a configuration.
When Monitored	Auto Mode
Possible Causes	The safety board had a software crash.
Initial Action	Resume autoscrub

5-F6CC Safety Comms

Description	Communication lost to the Platform Board
Fault Name	KNIGHT_COMP_ERR_AUTOSAFETY_PLATFORMPCBCOMMS
Setting Conditions	Compute Board lost communication to Platform Board
When Monitored	Auto Mode
Possible Causes	Autonomy Module internal cabling issue
Initial Action	Reboot. If the error persists, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-F6CD Safety Over-Speed

Description	Unused
Fault Name	KNIGHT_COMP_ERR_AUTOSAFETY_OVERSPEED

5-F6CE Wheel Encoder

Description	Bad wheel encoder
Fault Name	KNIGHT_COMP_ERR_AUTOSAFETY_WHEELENCODER
Setting Conditions	Scrubber traveled without getting Wheel Encoder data
When Monitored	Auto Mode
Possible Causes	Faulty wheel encoder
Initial Action	

Troubleshooting Steps

1. Inspect the wheel encoder sensors and disks for debris.
    - If fouled, clean the sensors and disks, and continue below to validate the repair.
2. Perform the Rear Wheel Encoders described on page 140, and correct any errors detected.

5-F6CF High-Speed Turn

Description	High-speed turn detected
Fault Name	KNIGHT_COMP_ERR_AUTOSAFETY_HIGHSPEEDTURN

Setting Conditions	Steering encoder indicates the scrubber is turning quickly
When Monitored	Auto Mode
Possible Causes	Improperly set steering encoder. Intermittent connectivity issue with steering encoder line.
Initial Action	Calibrate steering encoder

5-F6D0 Failed Prep Plan

Description	Failed to prepare a plan for running
Fault Name	KNIGHT_COMP_ERR_AUTO2_PLANPREPFAIL
Setting Conditions	Internal software error with main machine controller
When Monitored	Auto Mode
Possible Causes	The autonomy module encountered an internal software error when attempting to generate the plan.
Initial Action	Delete plan and recreate it

5-F6D1 SLAM Correspondence

Description	Kidnapped Robot Solver Insufficeint Correspondence
Fault Name	KNIGHT_COMP_ERR_AUTO2_KRSCORRESPONDENCE
Setting Conditions	The mapping laser is not providing enough valid points to match laser scans. Scrubber is along a wall and there is an
open space.	
When Monitored	Start of Auto Mode
Possible Causes	Scrubber is along a wall and there is an open space and there isn’t enough features in the environment.
Initial Action	Turn scrubber 45 degrees at the same start point and attempt playback again. If that fails, retrain plan.

5-F6D2 SLAM Convergence

Description	Kidnapped Robot Solver Failed to Converge
Fault Name	KNIGHT_COMP_ERR_AUTO2_KRSCONVERGENCE
Setting Conditions	The algorithm doesn’t have enough information from the current mapping laser scan to match the saved laser scan recorded when a path was trained. The two laser scans have
nothing in common.	
When Monitored	Auto Mode
Possible Causes	Scrubber is not facing the direction of travel of the plan. Location tag was moved.
Initial Action	Delete tag or retrain plan.

5-F6D3 SLAM Correction

Description	Kidnapped Robot Solver Correction was too large
Fault Name	KNIGHT_COMP_ERR_AUTO2_KRSCORRECTION
Setting Conditions	The algorithm outputted a correction that was larger than expected.
When Monitored	Auto Mode
Possible Causes	Scrubber has poor initial estimate when starting the plan.
Initial Action	Drive to location tag then drive back to start of plan.

Troubleshooting Steps

Retrain plan if problem continues.

5-F6D4 SLAM Overlap

Description	Kidnapped Robot Solver did not have enough overlap
Fault Name	KNIGHT_COMP_ERR_AUTO2_KRSOVERLAP
Setting Conditions	The algorithm doesn’t have enough information from the current mapping laser scan to match the saved laser scan recorded when a path was trained. The two laser scans are
not enough in common	
When Monitored	Auto Mode
Possible Causes	Scrubber is not facing the direction of travel of the plan.
Initial Action	Turn scrubber about a quarter turn and start the plan.

5-F6D5 SLAM Failed

Description	Kidnapped Robot Solver Failed
Fault Name	KNIGHT_COMP_ERR_AUTO2_KRSFAILED
Setting Conditions	The algorithm doesn’t have enough information from the current mapping laser scan to match the saved laser scan recorded when a path was trained. The two laser scans are
not enough in common.	
When Monitored	Auto Mode
Possible Causes	Scrubber is not facing the direction of travel of the plan.
Initial Action	Turn scrubber about a quarter turn and start the plan.

Troubleshooting Steps

Retrain plan if problem continues.

5-F6D6 EKF Error

Description	EKF Covariance is too large

Fault Name	KNIGHT_COMP_ERR_AUTO2_EKFCONFIDENCE
Setting Conditions	Mathematical variance between predictive and measurable location determination is too large.
When Monitored	Auto Mode
Possible Causes	The environment is devoid of distinctive features, such as a long hallway or a large empty room.
Initial Action	

Troubleshooting Steps

This can happen if the wheel encoders, laser scans, and IMU are indicating that the robot is in different positions.

1. Calibrate 2D Mapping LIDAR
2. Check the wheel encoders

If the area is big, add a feature to the room to help with positioning for the 2D LIDAR.

5-F6D7 Auto Exit Bad Calib

Description	Scrubber failed to calibrate correctly - cannot go into auto.
Fault Name	KNIGHT_COMP_ERR_AUTO2_AUTOEXITCALIB
Setting Conditions	The scrubber attempted to enter auto but failed a calibration check.
When Monitored	Auto Mode
Possible Causes	Either the drop-off sensor, or 3D Camera is not calibrated.
Initial Action	Calibrate sensors. See other error code to determine what to calibrate.

5-F6D8 Auto Exit SteerConsist

Description	Scrubber Drive Wheel Angle Sensor and wheel encoder angles deviated too much.
Fault Name	KNIGHT_COMP_ERR_AUTO2_STEERINGCONSIST
Setting Conditions	Scrubber steering encoder and wheel encoder angles deviated too much.
When Monitored	Auto Mode
Possible Causes	The autonomy module has detected a discrepancy between wheel encoder data and steering encoder data for too long of a time/distance period.
Initial Action	Calibrate steering encoder and check wheel encoders.

5-F4DD Proximity Obstacle

Description	Auto-scrub unable to continue, obstacle detected by proximity sensor blocking all plans
Fault Name	KNIGHT_COMP_INFO_AUTO2_PROXIMITYNOPRIM
Setting Conditions	The vehicle wasn't able to find a path because the Safety LIDAR sees an obstacle in the way
When Monitored	Auto Mode
Possible Causes	An obstacle in the way or a dirty laser
Initial Action	Clean laser or move obstacle

5-F6F1 Boot Timeout

Description	A timeout occurred while loading safety configuration.
Fault Name	KNIGHT_COMP_ERR_BOOT2_SFTYCFGLD
Setting Conditions	A timeout occurred while loading safety configuration.
When Monitored	Bootup
Possible Causes	Internal Error
Initial Action	If the error persists, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-F6F2 Boot Timeout

Description	Invalid safety configuration data was found.
Fault Name	KNIGHT_COMP_ERR_BOOT2_SFTYCFGNULL
Setting Conditions	Invalid safety configuration data was found.
When Monitored	Bootup
Possible Causes	Internal Error
Initial Action	If the error persists, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-F6F3 Boot Timeout

Description	A timeout occurred while sending safety configuration.
Fault Name	KNIGHT_COMP_ERR_BOOT2_SFTYCFGTIMEOUT
Setting Conditions	A timeout occurred while sending safety configuration to the safety board.
When Monitored	Bootup
Possible Causes	Internal Error
Initial Action	If the error persists, contact Nilfisk Technical Support for authorization to replace the autonomous module.

5-F6F6 IMU Boot Error

Description	The Autonomy Kit detecteded an IMU Error on bootup.
Fault Name	KNIGHT_COMP_ERR_BOOT2_IMUERROR
Setting Conditions	IMU in the autonomy module has an error
When Monitored	Bootup
Possible Causes	Broken IMU
Initial Action	Replace Autonomy module

5-F4F7 Sec Safety LIDAR Boot

Description	A timeout occurred while waiting over Ethernet for Secondary Laser Scanner Info.

Setting Conditions	Autonomy Module waited more than 30 seconds to communicate with the right Safety LIDAR.
When Monitored	Bootup
Possible Causes	Ethernet cable not connected to the right Safety LIDAR.
Initial Action	Check ethernet cable between autonomy module and the right safety LIDAR

Troubleshooting Steps

The system will still operate without an Ethernet connection to the Secondary Safety LIDAR

5-F5F8 Bad 3D Vision Sens Cal

Description	An invalid 3D Vision Sensor calibration was found during boot
Setting Conditions	Autonomy Module the position of the 3D Vision Sensor relative to the scrubber is not within acceptable ranges
When Monitored	Bootup
Possible Causes	Upgrading the software to a more recent version. This check was added in newer versions of software.
Initial Action	Calibrate Camera

Troubleshooting Steps

5-F790 Service Exception

Description	Exception from service state Scrubber
Fault Name	KNIGHT_COMP_FATAL_SERVICE_EXCEPTION
Setting Conditions	Unexpected Internal fault in Autonomy Module
When Monitored	Always
Possible Causes	Autonomy Module Internal Error
Initial Action	Reboot Scrubber

Troubleshooting Steps

This is an unhandled error condition with no specific known cause. Diagnose all other error conditions first.

5-F7DA Braking for interlock

Description	The Interlock assertion failed to invoke the system to stop
Fault Name	KNIGHT_COMP_FATAL_AUTO2_INTRLCKNOTESTBLSHD
Setting Conditions	The interlock assertion is not being responded by decrease in velocity for configurable time
When Monitored	Auto Mode
Possible Causes	Front Wheel EM brake not functioning
Initial Action	Inspect front wheel EM brake

5-FB00 Interlock Boot Err

Description	Platform Board interlock failed on boot

Fault Name	KNIGHT_SAFE_FATAL_ILOK_BOOT
Setting Conditions	Unexpected Platform Board Interlock voltage reading.
When Monitored	Bootup
Possible Causes	Platform interlock failed on startup. Short circuit with interlock line
Initial Action	

Troubleshooting Steps

1. Check the voltage between J6-20 and J6-22 while the machine is booting up.
    - The voltage should transition from low (0V) to high (24V) when the Autonomy module completes thebootup process. If the transition occurs correctly, but the error persists, replace the Autonomy module.
2. Power down the machine, and disconnect the J4 connector from the drive controller.
3. Check the voltage between J6-20 and J6-22 while the machine is booting up. (Ignore errors related to the disconnected drive controller.)
    - If the Auto OK signal transitions from low to high (but didn't previously), replace the Drive controller.
    - If the Auto OK signal still fails to transition, continue.
4. Power down the machine, and disconnect the J6 connector from the Autonomy module. (J4 is still disconnected).
5. Check the resistance between J6-20 and all other J6 contacts.
6. Check the resistance between J4-11 and all other J4 contacts.
    - If any resistance reading above indicates short circuit (at or near 0 ohms), Repair or replace the harness.
    - If no short circuit is detected, replace the Autonomous controller.

5-FC00 MMC Known Fault

Description	A valid fault code for MMC
Fault Name	KNIGHT_KMCB_INFO_EMCYLOG_KNOWN
Setting Conditions	The Main Machine Controller issued a fault code
When Monitored	Always
Possible Causes	Various
Initial Action	Check main control board fault codes

5-FC01 Unknown MMC Fault

Description	An unknown fault code for MMC
Fault Name	KNIGHT_KMCB_INFO_EMCYLOG_UNKNOWN
Setting Conditions	Main Module Controller alerted the Autonomy module of a unknown issue
When Monitored	Auto Mode
Possible Causes	Various
Initial Action	Check for other fault codes on the Main Module Controller

5-FC20 MMC Low Battery

Description	The MMC exited auto-scrub due to a low battery
Fault Name	KNIGHT_KMCB_INFO_EXITAUTOSCRUB_LOWBATTERY
Setting	The main controller issued a message that the battery voltage is low, and the Autonomy module

Conditions	has exited auto mode.
When Monitored	Auto Mode
Possible Causes	Battery low or wiring issues
Initial Action	Check main control board fault codes

5-FC21 MMC Out of Water

Description	The MMC exited auto-scrub because the scrubber ran out of water
Fault Name	KNIGHT_KMCB_INFO_EXITAUTOSCRUB_OUTOFWATER
Setting Conditions	The Main Machine Controller issued a message that auto- scrub should be exited because the machine is out of water
When Monitored	Auto Mode
Possible Causes	No more water
Initial Action	Fill clean water tank with water.

5-FC22 MMC Full Recovery Tank

Description	The MMC exited auto-scrub because the recovery tank is full
Fault Name	KNIGHT_KMCB_INFO_EXITAUTOSCRUB_RECOVERYTANKFULL
Setting Conditions	The Main Machine Controller issued a message that auto-scrub should be exited because the recovery tank is full
When Monitored	Auto Mode
Possible Causes	Recovery Tank full
Initial Action	Empty recovery tank

5-FC25 MMC ESTOP Pressed

Description	The MMC's ESTOP button was pressed
Fault Name	KNIGHT_KMCB_INFO_EXITAUTOSCRUB_ESTOPPRESSED
Setting Conditions	CANBus message. The autonomy module does not monitor the E-stop circuit.
When Monitored	Auto Mode
Possible Causes	Operator pressed ESTOP during autoscrub
Initial Action	Release ESTOP and resume plan.

5-FC26 MMC Charging

Description	The MMC is charging
Fault Name	KNIGHT_KMCB_INFO_EXITAUTOSCRUB_CHARGING
Setting Conditions	The Main Machine Controller reported that

the battery charger is active.

When Monitored	Auto Mode
Possible Causes	The vehicle was plugged in while in automode.
Initial Action	Stop machine before plugging it in.

5-FC27 MMC exit UVGI

Description	The MMC exited auto-scrub because the UVGI error
Setting Conditions	The UGVI is not properly turning on or off.
When Monitored	Auto Mode
Possible Causes	Malfunctions in the UVGI unit
Initial Action	Troubleshoot the UVGI unit. Check for additional faults.

Troubleshooting Steps

5-FC30 No Autoscrub Heartbeat

Description	The MMC lost a heartbeat from the Autonomy Module in auto-scrub
Fault Name	KNIGHT_KMCB_INFO_KCMBCOMM_NOHEARTBEATAUTOSCRUB
Setting Conditions	Software heartbeats lost for more than 250 ms
When Monitored	Auto Mode
Possible Causes	Autonomy Software issue. Either autonomy software crashed or locked up during autoscrub.
Initial Action	Check other fault codes

5-FC31 No Manual Heartbeat

Description	The MMC lost a heartbeat while in manual mode
Fault Name	KNIGHT_KMCB_INFO_KCMBCOMM_NOHEARTBEATMANUAL
Setting Conditions	Software heartbeats lost for more than 250 ms
When Monitored	Manual Mode
Possible Causes	Autonomy Software issue. Either autonomy software crashed or locked up during manual mode.
Initial Action	Check other fault codes

5-FD23 MMC Hardware Failure

Description	The MMC had an internal hardware error
Fault Name	KNIGHT_KMCB_WARN_EXITAUTOSCRUB_INTERNALHARDWARE
Setting Conditions	The Main Module Controller reported it had an internal hardware error
When Monitored	Auto Mode
Possible Causes	Hardware malfunction detected by the Main Module Controller.
Initial Action	See fault codes on Maim Module controller

5-FE10 MMC Out of Sync Mode

Description	The MMC is at a different mode than the Autonomy Module
Fault Name	KNIGHT_KMCB_ERR_MODEREQUEST_OUTOFSYNC
Setting Conditions	Autonomy Module sent an unexpected mode to Main Machine Controller. No loss of operation
When Monitored	Auto Mode
Possible Causes	Version incompatibility between main controller and Autonomy Module
Initial Action	Update firmware for main controller and autonomy module

5-FE11 MMC Manual Fail

Description	The autonomy kit did not respect MMC's desire to change to Manual mode in time
Fault Name	KNIGHT_KMCB_ERR_MODEREQUEST_FAILEDMANUAL
Setting Conditions	The autonomy kit did not respect Clean Board’s desire to change to Manual mode in
time	
When Monitored	Auto Mode
Possible Causes	Version incompatibility between main controller and Autonomy Module
Initial Action	Update firmware for main controller and autonomy module

5-FE12 MMC Copy-Cat Fail

Description	The autonomy kit did not respect MMC's desire to change to Copycat mode in time
Fault Name	KNIGHT_KMCB_ERR_MODEREQUEST_FAILEDTRAINCOPYCAT
Setting Conditions	The autonomy kit did not respect Clean Board’s desire to change to Copycat mode in time
When Monitored	Manual Mode
Possible Causes	Version incompatibility between main controller and Autonomy Module
Initial Action	Update firmware for main controller and autonomy module

5-FE13 MMC Fill-In Fail

Description	The autonomy kit did not respect MMC's desire to change to Fill-in mode in time
Fault Name	KNIGHT_KMCB_ERR_MODEREQUEST_FAILEDTRAINFILLIN
Setting Conditions	The autonomy kit did not respect Clean Board’s desire to change to Autoscrub mode in time
When Monitored	Manual Mode
Possible Causes	Version incompatibility between main controller and Autonomy Module
Initial Action	Update firmware for main controller and autonomy module

5-FE14 MMC Auto Fail

Description	The autonomy kit did not respect MMC's desire to change to Auto-scrub mode in time
Setting Conditions	Autonomy Module didn't respond to MMC's request to change state to auto
When Monitored	Auto Mode

Possible Causes	Incompatible MMC version or software crash on the Autonomy module.
Initial Action	Retry autoscrub, if problem persists, reboot scrubber.

5-FE15 Out of Range Mode

Description	The Autonomy Module sent an out-of-range value to the MMC
Fault Name	KNIGHT_KMCB_ERR_MODEREQUEST_OUTOFRANGE
Setting Conditions	This error is set by the main machine controller. The MMC received a mode request invalid data.
When Monitored	Always
Possible Causes	Version incompatibility between main controller and Autonomy Module
Initial Action	Update firmware for main controller and autonomy module

5-FE24 MMC Lost Comms

Description	The MMC lost communication with the Compute Board
Fault Name	KNIGHT_KMCB_ERR_EXITAUTOSCRUB_NOHEARTBEAT
Setting Conditions	Clean Board lost heartbeats to Autonomy Module for more than 4 seconds
When Monitored	Auto Mode
Possible Causes	Intermittent Internal Autonomy Software Error
Initial Action	Resume autoscrub or Reboot machine

5-FE32 MMC Buffer Full

Description	The MMC's CAN buffer is filling up. Possible spamming of CAN messages
Fault Name	KNIGHT_KMCB_ERR_KCMBCOMM_BUFFERFULL
Setting Conditions	The MMC's CAN buffer is filling up. Possible spamming of CAN messages
When Monitored	Always
Possible Causes	Malfunction device on the CAN network
Initial Action	See other fault codes

5-FE33 MMC Timeout

Description	The MMC detected a 2-second timeout with no messages.
Fault Name	KNIGHT_KMCB_ERR_KCMBCOMM_TIMEOUT
Setting Conditions	The main machine controller has not detected any messages from the autonomy module for 2 seconds.
When Monitored	Auto Mode
Possible Causes	CANBus wire fault. Autonomy module fault.
Initial Action	Reboot the machine

Troubleshooting Steps

If the battery charger is not experiencing any CANBus errors, then any fault must lie either with the autonomy module, or within the first several inches of the autonomy module. The splice point where the TrackClean module and battery charger split off from the twisted pair of CANBus wires is located just past the junction in the main harness where the autonomy module splits off.

1. Shut down the machine and unplug the main battery disconnect to protect the autonomy module.
2. Disconnect the J6 connector from the autonomy module.
3. Check the resistance between contacts J6-3 and J6-4 of the autonomy harness connector.
    - If the resistance is either open circuit or short circuit, repair or replace the twisted pair wiring between the autonomy module and the first splice point encountered.
    - If the resistance is near 120 ohms, reconnect the J6 connector, and continue to the next step.
4. Before concluding that the autonomy module is defective, validate the error.
    a. Reconnect the main battery and boot up the machine.
    b. Observe whether the error persists.
    c. Navigate to the service menu and then the autonomy menu, and scroll through the parameters to determine if new data is being reported.
        - If loss of communication with the autonomy module is confirmed, replace the autonomy module.

5-FE34 MMC Queue Err

Description	The MMC detected a corrupt or garbled message in the queue.
Fault Name	KNIGHT_KMCB_ERR_KCMBCOMM_QUEUEERROR
Setting Conditions	The Clean Board detected a corrupt or garbled message in the queue.
When Monitored	Always
Possible Causes	Loose connection or noise on the CAN0 CANBus.
Initial Action	Reboot the machine

Troubleshooting Steps

If the battery charger is not experiencing any CANBus errors, then any fault must lie either with the autonomy module, or within the first several inches of the autonomy module. The splice point where the TrackClean module and battery charger split off from the twisted pair of CANBus wires is located just past the junction in the main harness where the autonomy module splits off.

1. Shut down the machine and unplug the main battery disconnect to protect the autonomy module.
2. Disconnect the J6 connector from the autonomy module.
3. Check the resistance between contacts J6-3 and J6-4 of the autonomy harness connector.
    - If the resistance is either open circuit or short circuit, repair or replace the twisted pair wiring between the autonomy module and the first splice point encountered.
    - If the resistance is near 120 ohms, reconnect the J6 connector, and continue to the next step.
4. Before concluding that the autonomy module is defective, validate the error.
    a. Reconnect the main battery and boot up the machine.
    b. Observe whether the error persists.
    c. Navigate to the service menu and then the autonomy menu, and scroll through the parameters to determine if new data is being reported.
        - If loss of communication with the autonomy module is confirmed, replace the autonomy module.

5-E681 Drop-Off request timeout

Description	The Autonomy module did not receive a response to the SDO
Setting Conditions	The Autonomy module did not receive a response to the SAFETY_DROPOFFDISABLE SDO for 5 seconds
When Monitored	Training Mode
Possible Causes	MMC and Autonomy Error
Initial Action	Check the CAN connection between the Autonomy module and the MMC

5-F6DE Drop-Off request timeout

Description	The Autonomy module did not receive a response to the SDO
Setting Conditions	The Autonomy module did not receive a response to the SAFETY_DROPOFFDISABLE SDO for 5 seconds
When Monitored	Both Training and Auto Mode
Possible Causes	MMC and Autonomy Error
Initial Action	Check the CAN connection between the Autonomy module and the MMC. Verify the versions are correct.

5-E4B0 Steering Encoder Range

Description	The value measured from the steering encoder is out of range.
Setting Conditions	The value measured from the steering encoder is outside the expected value of +/- 100 degrees.
When Monitored	Always
Possible Causes	The steering encoder isn't properly centered.
Initial Action	Re-center steering encoder

5-E4B1 Clock Battery Dead

Description	The system time wasn’t set on bootup
Setting Conditions	The system time was too far in the past. This is due to the clock not being set on bootup.
When Monitored	Auto Mode
Possible Causes	Dead clock battery
Initial Action	RMA unit, if desired

Troubleshooting Steps

The system will still scrub properly with a incorrect time. However, the time in the robot reports won't be accurate.