Telemetry Values and Their Ranges

It is the job of the HMD Display to alert the astronaut and MCC Display to alert MCC if any of these value fall outside their nominal bounds.

Value	Units	Min	Nominal	Max
batt_time_left	seconds	3,600	-	10,800
oxy_pri_storage	%	20	-	100
oxy_sec_storage	%	20	-	100
oxy_pri_pressure	psi	600	-	3,000
oxy_sec_pressure	psi	600	-	3,000
oxy_time_left	seconds	3,600	-	21,600
coolant_storage	%	80	100	100
heart_rate	bmp	50	90	160
oxy_consumption	psi/min	0.05	0.1	0.15
co2_production	psi/min	0.05	0.1	0.15
suit_pressure_oxy	psi	3.5	4.0	4.1
suit_pressure_co2	psi	0.0	0.0	0.1
suit_pressure_other	psi	0.0	0.0	0.5
suit_pressure_total	psi	3.5	4.0	4.5
helmet_pressure_co2	psi	0.0	0.1	0.15
fan_pri_rpm	rmp	20,000	30,000	30,000
fan_sec_rpm	rmp	20,000	30,000	30,000
scrubber_a_co2_storage	%	0	-	60
scrubber_b_co2_storage	%	0	-	60
temperature	°F	50	70	90
coolant_liquid_pressure	psi	100	500	700
coolant_gas_pressure	psi	0	0	700

Suit Resources:

These values are filled up while using the UIA in the Egress procedures of the EVA. The Battery is filled up when the DCU is connected to the UIA, and the Oxygen Tanks are filled up during the procedure.

These values have no nominal values and are dropping throughout the extent of the EVA. The minimum safety value is when there is an hour of oxygen, or an hour of battery left.

The Coolant is filled up on egress and internally recycled.

Suit Atmosphere:

The atmosphere of the suit is an extremely safety critical system. The partial pressures of each gas in the atmosphere must be kept at the appropriate values. Too much of any one thing can be detrimental. The goal of this system is to keep the partial pressure of oxygen at 4.0 psi, and the partial pressures of everything else at 0.0 psi. There are a lot of factors that can push things out of these bounds.

Once the EVA begins, the astronaut is constantly consuming oxygen and producing carbon dioxide. Oxygen is being supplied from the oxygen tanks that are filled during egress. Carbon dioxide is collected by the carbon dioxide scrubbers and released into space. One of the main issues that early suits found is that the carbon dioxide likes to pool in the helmet and has trouble distributing throughout the suits where it can be more easily collected. To assist with this, fans were added in the helmet to help push the carbon dioxide towards the carbon dioxide scrubbers.

Suit Helmet Fan:

The fans distribute carbon dioxide from the helmet to the rest of the space suit. Each suit has two fans, a primary and secondary fan. Only one fan is on at a time. Each fan should be spinning at 30,000 rpm. The speed of the fan determines how much carbon dioxide is moved from the helmet to the rest of the suit. If the fan speed is too low, not enough carbon dioxide will be pushed into the scrubbers and the helmet bubble will fill with carbon dioxide. Too much carbon dioxide in the helmet bubble can impair the astronaut so it must be kept below 0.15 psi.

Suit CO2 Scrubbers:

The suit has two alternating carbon dioxide scrubbers. One scrubber is collecting carbon dioxide from the suit while the other is ejecting it's collected carbon dioxide into space. There is a switch on the DCU to alternate the scrubbers. This is necessary because as the EVA goes on, one of the scrubbers will fill up and become less efficient. If this goes unnoticed for too long, the suit will start to fill with carbon dioxide. The astronaut must be told that their scrubber is almost full and that they need to alternate the scrubbers, to start filling up the empty scrubber and ejecting the contents of the full scrubber.

These do not have a nominal value since they are constantly filling and emptying.

Suit Temperature:

Because of how well the space suit is insulated, the temperature inside the suit fluctuates drastically based on physical activity. There is a record of an astronaut on a lunar EVA being told to slow down because his suit was getting too hot. Our suits will have a simulated temperature value. As the suit gets hot, the coolant will heat up and can turn gaseous while the radiator

cools it off. The coolant is filled during the egress process, and self manages the temperature throughout the rest of the EVA.

Handling Error Scenarios:

heart_rate

Alert that the detected Heart Rate is too high and that the astronaut will need to slow down for a second.

suit_pressure_oxy

The Primary Oxygen Tank is not suppling enough (or too much) oxygen and we must swap to the Secondary Oxygen Tank. This is done using the Oxygen Switch on the DCU.

suit_pressure_co2

The scrubber has filled up and must be vented. This is done using the Carbon Dioxide Switch on the DCU.

suit_pressure_other

The partial pressure of all other gases should be zero in the suit after the decompress sequence. Alter the user if this value is too high only after that step.

suit_pressure_total

The suit total pressure being too low/high alludes to a problem with either the oxygen tank or the scrubber. Review those values and perform their procedures.

helmet_pressure_co2

The helmet carbon dioxide partial pressure builds up on a fan failure. Swap to the secondary fan. This is done using the Fan Switch on the DCU.

fan_pri_rpm and *fan_sec_rpm*

If either of the fans are on and not spinning at the expected 30,000 rpm, then there is a fan error. Swap to the secondary fan. This is done using the Fan Switch on the DCU.

scrubber_a_co2_storage and *scrubber_a_co2_storage*

If either scrubber filled beyond 60% capacity, it must be vented. This will happen a few times during the EVA and the astronaut should be alerted that they need to vent their collected carbon dioxide. This is done by flipping the Carbon Dioxide Switch on the DCU.

Temperature

Alert that the detected temperature is too high and that the astronaut needs to slow down.