Energy Storage IED Controller

This document is meant to document the software and hardware interfaces to the Energy Storage IED Controller. This controller is currently being used in both the RTDS testbed and in the full-voltage DECC Lab implementation. Currently differences between the two varieties will be documented here, although it is possible that the two will become different enough to require independent documentation.

# Software Interface

The device interfaces with the microgrid controller through Modbus over TCP. Below are definitions of the Modbus commands and addresses.

## IP Address and Port

### RTDS

#### IP Address

The IP Address of the RTDS variety will be statically assigned as 192.168.48.xxx.

#### Port

The port used for Modbus communication is 502.

### DECC

#### IP Address

The IP Address of the RTDS variety will be statically assigned as 192.168.48.xxx.

#### Port

The port used for Modbus communication is 502.

## Modbus Communication

### Commands

These are commands sent from SCADA to the IED. These cause changes of state directly.

|  |  |  |
| --- | --- | --- |
| Address | Keyword | Description |
| 00010 | Activate | Causes the IED to move from an inactive to an active state |
| 00020 | Deactivate | Causes the IED to move from an active to an inactive state |
| 10032 | Sync | When in V/f mode, causes the IED to prepare for grid synchronization |
| 10030 | Generation Mode | Default (F) behavior is PQ Mode. Active (T) makes it go into V/f |
| 10031 | Droop | Causes Droop to be on (T) or off (F) |

### Statuses

These are status registers that give information from the IED to SCADA about change of states.

|  |  |  |
| --- | --- | --- |
| Address | Keyword | Description |
| 10010 | Activate | Whether or not the IED is in an active state |
| 10011 | Deactivate | Whether or not the IED is in an inactive state |

### Variables

These registers contain static information about the IED needed for operation and optimization.

|  |  |  |
| --- | --- | --- |
| Address | Keyword | Description |
| 30010 | Activate Timeout | Specifies the maximum amount of time (in seconds) that the IED should take to activate |
| 30020 | Deactivate Timeout | Specifies the maximum amount of time (in seconds) that the IED should take to deactivate |
| 34083 | Battery Capacity | The maximum capacity of the battery (in kW-Hrs) |
| 39403 | Ramp Rate | The rate at which the source can increase power output (in W/s) |

### Setpoints

These registers contain the values used as setpoints for power generation.

|  |  |  |
| --- | --- | --- |
| Address | Keyword | Description |
| 40030 | Real | Target value for Real Power generation |
| 40040 | Reactive | Target value for Reactive Power generation |
| 40050 | Voltage | Target value for RMS Voltage |
| 40060 | Frequency | Target Frequency |

### Measurements

These registers pass measurements from the IED to SCADA. Scaling on the SCADA side may be necessary to convert from L-L to L-N or vice-versa.

|  |  |  |
| --- | --- | --- |
| Address | Keyword | Description |
| 30030 | Phase A Current | Current on Phase A (Amps). Positive is Current out (Discharge). |
| 30040 | Phase B Current | Current on Phase B (Amps). Positive is Current out (Discharge). |
| 30050 | Phase C Current | Current on Phase C (Amps). Positive is Current out (Discharge). |
| 30130 | Phase A Voltage | Voltage on Phase A (Volts). |
| 30140 | Phase B Voltage | Voltage on Phase B (Volts). |
| 30150 | Phase C Voltage | Voltage on Phase C (Volts). |
| 30230 | Phase A Real Power | Real Power on Phase A (Watts). Positive is output power. |
| 30240 | Phase B Real Power | Real Power on Phase B (Watts). Positive is output power. |
| 30250 | Phase C Real Power | Real Power on Phase C (Watts). Positive is output power. |
| 30330 | Phase A Reactive Power | Reactive Power on Phase A (Watts). Positive is output power. |
| 30340 | Phase B Reactive Power | Reactive Power on Phase B (Watts). Positive is output power. |
| 30350 | Phase C Reactive Power | Reactive Power on Phase C (Watts). Positive is output power. |
| 30500 | State of Charge | The state of charge of the battery (0-100). |

### Watchdog

This register is used to provide watchdog functionality to the IED. If the value in the register doesn’t change within 10 seconds the IED is to assume it has lost communication with SCADA.

|  |  |  |
| --- | --- | --- |
| Address | Keyword | Description |
| 40010 | Watchdog | Register that changes over time when connected to SCADA. |