



AI-Kit Register Mapping - INVT

Version 1.0

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1. Purpose

This document defines the INVT VFD Modbus register mapping to be used by the AI-Kit Edge Controller firmware when VFD_TYPE = INVT. The purpose is to keep INVT-specific register addresses, scaling, and status decoding separate from the cloud telemetry specification.

This document is read-only for Version 1.0 telemetry integration. Remote write operations are reserved and shall remain disabled unless separately approved after validation and safety testing.

2. Communication Parameters

Parameter	Recommended / Default	Notes
Protocol	Modbus RTU	Over RS485 physical layer.
Slave ID	1	Field configurable based on VFD setting.
Baud Rate	19200	Recommended default; must match VFD setting.
Data Bits	8	Standard Modbus RTU setting.
Parity	Even	Represented as E in local configuration.
Stop Bits	1	Recommended default.
Timeout	1 second	Firmware shall retry on timeout.
Function Code	03	Read Holding Registers for telemetry registers.

3. Register Block

Block	Start Register	Length	Function	Purpose
Telemetry Block	0x3000	7 registers	03 - Read Holding Registers	Primary VFD telemetry block used for normalized AI-Kit telemetry.
Status Register	0x2100	1 register	03 - Read Holding Registers	Operating state / run status.
Fault Register	0x5000	1 register	03 - Read Holding Registers	Fault code. Zero indicates no active fault.

4. Status Register

The firmware shall read the INVT status register and convert the result into the normalized AI-Kit run_status field. The raw status value may also be retained internally for diagnostics.

Register	Telemetry Field	Scaling	Notes
0x2100	run_status	Mapping table in Section 8	Operating status decoded into normalized pump running status.

5. Fault Register

The firmware shall read the INVT fault register and map the value into the normalized AI-Kit fault_code field.

Register	Telemetry Field	Scaling	Notes
0x5000	fault_code	Raw integer code	0 = no active fault. Non-zero values shall be reported without suppression.

6. Register Mapping

Register	Raw Name	AI-Kit Field	Scaling	Unit / Notes
0x3000	Output frequency	frequency_hz	raw / 100	Hz
0x3001	Set frequency	set_frequency_hz	raw / 100	Hz; internal/diagnostic field unless required by cloud.
0x3002	Bus voltage	bus_voltage_v	raw / 10	V; internal/diagnostic field unless mapped to pv_voltage_v by site design.
0x3003	Output voltage	motor_voltage_v	raw / 10	V
0x3004	Output current	motor_current_a	raw / 10	A
0x3005	Output power percentage	power_pct	raw / 10	% of rated motor power
0x3006	Output torque percentage	torque_pct	raw / 10	% torque; internal/diagnostic field.
0x2100	Status word	run_status	Section 8 mapping	Normalized running status.
0x5000	Fault code	fault_code	raw integer	0 = no active fault.

7. Scaling

AI-Kit Field	Formula	Notes
frequency_hz	register_0x3000 / 100	Operating frequency in Hz.
set_frequency_hz	register_0x3001 / 100	Set frequency in Hz.
bus_voltage_v	register_0x3002 / 10	DC bus voltage in V.

motor_voltage_v	register_0x3003 / 10	Motor output voltage in V.
motor_current_a	register_0x3004 / 10	Motor output current in A.
power_pct	register_0x3005 / 10	VFD output power percentage.
power_kw	power_pct * rated_motor_kw / 100	Derived only when rated_motor_kw is configured locally.
torque_pct	register_0x3006 / 10	Internal/diagnostic unless required later.

8. Status Mapping

Raw Status Value	Normalized run_status	Meaning	Firmware Action
0	0	Stopped / not running	Report run_status = 0.
1	1	Forward running	Report run_status = 1.
2	1	Reverse running	Report run_status = 1 unless reverse operation must be distinguished in diagnostics.
3	0	Stop / standby	Report run_status = 0.
Other	Raw retained; normalized as 0 unless verified running	Vendor-specific / undefined	Report safely and retain raw_status internally.

9. Firmware Sequence

1. Load local configuration: DEVICE_ID, API_KEY, FIRMWARE_VERSION, VFD_TYPE, RS485 parameters, sampling interval, upload interval, and rated_motor_kw where applicable.
2. Initialize UART / RS485 interface using configured Modbus parameters.
3. Select INVT VFD driver when VFD_TYPE = INVT.
4. Read telemetry block 0x3000 with length 7 using Modbus function 03.
5. Read status register 0x2100.
6. Read fault register 0x5000.
7. Validate response length and CRC for every Modbus response.
8. Apply scaling rules defined in this document.
9. Convert VFD-specific values into normalized AI-Kit telemetry field names.
10. Build JSON payload as defined in the AI-Kit Edge Controller Telemetry Integration & Cloud Communication Specification v1.1.
11. Store the telemetry record in the local circular buffer.
12. Upload telemetry to AI-Kit Cloud at the configured upload interval.
13. Retry failed reads/uploads and continue local buffering during communication outages.

10. Reserved Write Registers

The following write-related functions are reserved for future releases. They shall not be enabled in Version 1.0 of this INVT register mapping unless a separate written approval, safety validation, and field test procedure are completed.

Reserved Function	Register / Command	Status in v1.0	Notes
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Remote start	TBD / vendor command register	Disabled	No cloud-to-device start command in current release.
Remote stop	TBD / vendor command register	Disabled	No cloud-to-device stop command in current release.
Set frequency	TBD / vendor frequency command register	Disabled	Frequency writes require separate safety validation.
Fault reset	TBD / vendor reset command register	Disabled	Reserved for future controlled maintenance workflow.
Parameter modification	Vendor parameter registers	Disabled	No remote parameter writes in current release.

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Status: Approved for Firmware Development as a telemetry read mapping reference.