Application Description

Intelligent Electronic Devices (IEDs) has seen a slow, but decisive shift towards interoperable and open standards, led by protocols like IEC 61850, DNP3, and others. Though, these standards are widely accepted in the industry as superior communication protocols compared to ‘legacy’ and proprietary protocols, many devices in the market still use custom protocols which are meant to communicate with the tools / applications from a limited set of IEDs. Moreover, there are devices which use open protocols but is not at par with the requirements from the market where the functionality demanded from the protocol side are much higher.

These IED devices mandate the need for an external protocol gateway for interoperability with the new systems with smart technologies which makes the overall project cost on the higher side. Kalkitech SYNC 200 Series of IED Upgrade Modules provide provision for upgrading the devices directly by plugging these modules internally. Hence, compared to the conventional method of porting the devices with the new protocols and investing in extra R&D and product development, SYNC 200 module series offer the IED manufactures to upgrade to almost any protocols with minimal changes in product design, as well as faster go-to-market. Additionally, the incremental R&D efforts in keeping abreast with the latest protocol developments will need not be borne by the device manufacturer, and will be taken care by the professionals at Kalkitech.

The modules, being in various form factors and performance capabilities, are suited for numerous application areas for IED protocol upgrade including Protection Relays, Alarm Annunciators, Auto-reclosures, Transformer monitoring systems, RTU/PLCs, Inverters and Chargers, Meters and temperature sensors.

![Figure 1: Workflow of SYNC 200 Starter Kit](image-url)
Integration Of SYNC 200

SYNC 200 is plugged internally to the device connecting the TTL interface to the device port and Ethernet port is used to take the data out from the device. Other methods of interfacing are also possible including I2C for internal connectivity, as well as TTL/RS232 or TTL/RS485 conversion to expose the serial-based protocol outside. The complete integration process, including a minor board design and testing, can be completed in a time period of two to three weeks.

To facilitate easy development, Kalkitech provides SYNC 200 starter kit containing development board, individual SYNC 200 Module series, design details and a support package of twenty hours.

Development Board

All SYNC 200 module variants are available in starter kits, which contains a development board and other accessories required for testing the integration with the IED device. User can plug the module and get suitable inputs/outputs on RS232/RS485 options provided on the development board for testing the integration requirements. Development board also has option for testing the general purpose I/Os (maximum 20 nos.) that can be configured for user requirements. The starter kit enables the user to test the SYNC 200 module integration with their devices in a single day with full protocol configuration.

![Testing Process Conducted On Starter Kit](image)

Points to consider for Hardware Integration:

1. Decide on the model requirements considering factors like form factor, features and performance requirements
2. Decide on the interface with the vendor device – choose between TTL and I2C interfaces
   - TTL is easy for integration and is plug-and-play. TTL interface can only provide maximum speed of 115.2 kbps. If the vendor device needs to be integrated using RS232/RS485, a separate TTL to RS conversion circuit needs to be attached to the board
   - I2C allows high speed communication up to 400 kbps. I2C requires software modification for supporting the same
3. If considering IEC 61850 for high-speed communication, then decide and go for direct I/Os from OEM modules for fast transfer of GOOSE messages / custom requirements
   - The circuitry for GPIOs from SYNC 200 modules to contact terminals of vendor devices for DI and DO need to be considered in this case
4. Decide on RTC requirements
   - OEM boards does not have an inbuilt RTC, however the same can be interfaced through the I2C
5. Consider provision for 3.3V DC supply to the OEM with a maximum power consumption of 2W
6. Provide provision for external communication connector. External communication can be through Ethernet (on-board) / RS232/RS485 (external)

Note: Kalkitech provide sample circuit where the above points need to be considered to build a development board.

Points to consider for Software Integration:

The configuration tool provided by Kalkitech for SYNC 200 module series is EasyConnect - a complete plug-and-play package. The manufacturer can configure the required points and protocol mapping using EasyConnect configuration utility. These configurations can be made as a standard package and supplied with the specific protection relay/transformer monitoring device. The complete configuration for the device can be done in a day considering a specific
ICD with 500 points mapped to IEC61850.

Customization of EasyConnect can also be provided, so that the configuration tool can be closely integrated to the existing IED manufacturer’s tool. EasyConnect also has advanced diagnostic functions and other interaction requirements with SYNC 200 modules like firmware update and IP configuration.

**Features**

i. Performance and points support

SYNC 200 modules are designed to meet a wide ranging protocol performance requirements including Protection relay and transformer monitoring functionality. For SYNC 221 and SYNC 241 models, an optimized configuration containing 1000 points from Modbus to IEC 61850 meets an internal conversion time of <100 msec>. For low end performance requirements on the same models, the number of points can go up to 1500 points. SYNC 241 and SYNC 221 can also handle one-to-one, one-to-many conversion requirements.

SYNC 211 is a low end version and can handle maximum point count of 300 points only and is recommended only for the one-to-one conversion requirements.

ii. Enhanced I/O - GOOSE message bus

For meeting enhanced performance requirements, SYNC 200 modules (SYNC 221 and SYNC 241) support an enhanced GOOSE message bus. This allows the vendor to program the required number of GPIOs available in the OEM modules to be connected to direct digital inputs and outputs of the vendor device. These GPIOs can be configured to send (for digital inputs) and receive (for digital outputs) GOOSE messages. This can guarantee a GOOSE message speed of 20msec and can reach to an average of 10msec on customizing for the requirements.

iii. Protocol Support

Supports total of 30 protocols which includes custom protocols and open protocols. List of main protocols are IEC 61850 modbus, IEC101/103/104, DNP3.0 and IEC 61850.

iv. Hardware Key Features:

- Meets high speed (up to 210MHz, SYNC 221/241) to low speed (55 MHz, SYNC 211) requirements
- Meets up to 64MB RAM and 256 MB Flash (model dependent)
- Suitable form factors for meeting all the requirements
- Up to 4 TTL ports, 20 GPIOs, I2C, Als interfaces for integration with vendor Hardware
- 10/100 BASE-T Ethernet port for external connectivity
- Supports temperature range from -40oC to +85oC

**Kalkitech Support Details**

Kalkitech provides the following support function to help the device manufacturer integrate as well as maintain the protocol capabilities:

- Integration support – Kalkitech provides twenty hours of free integration support for hardware and software integration. This support is available on purchase on the SYNC 200 Starter Kit.
- KEMA IEC 61850 level-A certification support – Kalkitech provides support for IEC 61850 Level-A certification on vendor devices. This involves on-site deputation.
- Support after deployment – Kalkitech provides support for any other issues during the deployment. This is as per the AMC agreement.

**Future Roadmap**

- Dual Ethernet port support with redundancy
- Fiber optic Ethernet ports
- Dual port RAM interface support
- Support for 32 GPIOs
- IEC 61850-3 certification levels on Ethernet port

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