India Smart Grid Forum

ISGF White Paper

SMART METER SPECIFICATIONS OF LEADING METER MANUFACTURERS IN INDIA

Abstract

The objective of this Paper is to enlighten about the latest technologies and trends used in Advanced Metering Infrastructure (AMI). A survey of the nine leading meter manufacturers in India was conducted by ISGF. The survey consisted of four parts namely, Communications, Ports, Standards/Protocols and Power Consumption. This report will be submitted to the Telecommunications Engineering Centre (TEC) which is in the process of preparing recommendations that will be sent to the Department of Telecommunications (DoT). Also, the Bureau of Indian Standards (BIS) may be requested to consider this survey's findings and recommendations as inputs for the formulation of standards related to smart meters and AMI.

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About India Smart Grid Forum

India Smart Grid Forum (ISGF) is a public private non-partisan initiative of the Ministry of Power (MoP), Government of India for accelerated development of smart grid technologies in the Indian power sector. ISGF was set up in 2010 to provide a mechanism through which academia, industry; utilities and other stakeholders could participate in the development of Indian smart grid systems and provide relevant inputs to the government's decision making.

Table of Contents

Abbreviations

TEC – Telecommunications Engineering Centre
DoT – Department of Telecommunications
PLC – Power Line Carrier
6LoWPAN – IPv6 over Low Power Wireless Personal Area Network
GPRS – General Packet Radio Service
HSPA – High Speed Packet Access
LTE – Long Term Evolution
WiMax – Worldwide Interoperability for Microwave Access
IS – Indian Standard
BIS – Bureau of Indian Standards
DLMS – Device Language Message Specification
COSEM – Companion Specification for Energy Metering
IEEE – Institute of Electrical and Electronics Engineers
HAN – Home Area Network
FAN – Field Area Network
WAN – Wide Area Network
RF – Radio Frequency
IR – Infra Red
IEC – International Electrotechnical Commission
SEP – Smart Energy Profile
AMI – Advanced Metering Infrastructure

1. Introduction

Smart metering is an essential part of a smart grid. AMI features in the list of functionalities envisaged in the 14 smart grid pilot projects currently under execution in India. This is because there are tremendous benefits of using smart meters[1]. It is estimated that by 2020, over 800 million smart electric meters will be installed globally, and India is expected to emerge as a big market for AMI.

2. Objective

At present, India has many smart meter manufacturers even while standards are being evolved for smart metering[2]. For this reason, Working Group-4, ISGF, decided to conduct a survey, involving the leading smart meter manufacturers in India. This survey report is unique as it includes the specifications of smart meters, currently being produced in India. In other words, it is a one-of-its-kind use case in the smart metering industry that was prepared with the cooperation of ISGF members and showcases the technical aspect of the current scenario of the metering industry in India.

This report will be sent to the Telecommunications Engineering Centre (TEC), which is in the process of preparing recommendations that will be sent to the Department of Telecommunications (DoT)[3]. Also, the Bureau of Indian Standards (BIS) may be requested to consider this survey's findings and recommendations as inputs for the formulation of standards related to smart meters and AMI.

3. Survey conducted by ISGF

3.1 Questionnaire

The following was the questionnaire circulated to the participants by ISGF for the survey:

PART 1: COMMUNICATIONS

1. Type of communication module: Inbuilt/plug in/external?
2. Number of communication modules: 1 or 2?
3. Last mile communication technology used: PLC/ZigBee/6LoWPAN/Wi-Fi/other (please mention)?
4. WAN communication technology used: GPRS/WiMAX/Optical fiber/ other (please mention)?
5. Communication technology used for communications between the meter and smart appliances/In-Home Display?

PART 2: PORTS

6. Does the meter have an electrical port for remote access? What is its type: RS 232/RS 485/ other (please mention)?
7. Does the meter have an optical port for local access?
8. Any other port? If yes, please mention the type and the function of that port.

PART 3: STANDARDS/PROTOCOLS

9. Applicable standards: IS 15884/IS 15959/ IS 14451/other (please mention)?
10. Metering protocol used: DLMS/other (please mention)?

[1] To view the benefits of AMI to utilities and consumers, please visit http://indiasmartgrid.org/en/resource-center/Reports/ISGF_Report%20on%20Smart%20Metering%20Scenario%20in%20India.pdf

[2] Bureau of Indian Standards (BIS) is in the process of formulating standards for smart meters and AMI

[3] TEC is a unit under DoT

PART 4: POWER CONSUMPTION

11. Power consumption of meter excluding the communication module and connect/disconnect switch?
12. Power Consumption of communication module?
13. Power consumption of connect/disconnect switch?

3.2 List of Participants

The following meter manufacturers participated in the survey:
(Please note: Names are listed in a random order)

1. HPL Electric and Power Private Limited
2. JnJ Powercom Systems Limited
3. Larson & Toubro Limited
4. Genus Power Infrastructure Limited
5. NeST Group
6. Landis+Gyr Group India
7. Itron Inc.
8. Powrtec Energy Private Limited
9. EDMI Limited

3.3 Results of the survey

The following tables depict the results of the survey:

(Please note: M1, M2……M9 are the 9 meter manufacturers that took part in the survey.)

3.3.1 Part 1: Communications

Table 1: Results of survey - Part 1: Communications

Meter Manufacturer	Type of communication module (in-built/plug-in/external)	Number of communication modules in a meter+	Last mile communication technology (FAN) options	WAN communication technology options	Communication technology used for Home Area Network (HAN)
M1	in-built or plug-in	2	PLC (IEEE 1901.2-2013)	GPRS	PLC (IEEE 1901.2-2013)
			Hybrid++: PLC + IEEE 802.15.4	HSPA	6LoWPAN
			6LoWPAN	LTE	Wi-Fi
			Direct connect: GPRS/HSPA/LTE	WiMaX	
				Optical Fiber	
				Ethernet	
M2	in-built or plug-in	1	6LoWPAN	GPRS/EDGE/3G	RS 485
			Proprietary solution at 865MHz	Wired media(copper + optical fibre)	ZigBee
				Optical Fiber	

M3	in-built	2	Proprietary solution at 865 MHz	GPRS/EDGE/3G	ZigBee
M4	in-built	1	6LoWPAN	GPRS/EDGE/3G	ZigBee
			Other RF technologies at 865 MHz		Any RF technology at 865 MHz
			ZigBee		
			GPRS		
M5	In-built	1	PLC (PRIME and proprietary)	GPRS	PLC (PRIME and proprietary)
			6LoWPAN		ZigBee
M6	In-built	1	proprietary	GPRS	GPRS
M7	In-built	1	ZigBee	ZigBee	ZigBee
				Ethernet	
M8	In-built or plug-in (field swappable PLC and GPRS)	1 but there is a facility to incorporate the second for HAN	PLC (IEEE 1901.2)	GPRS	PLC (IEEE 1901.2)
				Optical fibre	RF
M9	In-built for local, remote/NAN and HAN (both wired and over the air applications)	1 for over the air	ZigBee	GPRS/EDGE/3G	ZigBee
	External for WAN		6LoWPAN	Optical fibre	
			GSM/GPRS		
			PLC under field trials		

[+] This does not include the communication module for the optical and electrical ports.

[++] Hybrid refers to 2 technologies in the meter for providing a back-up, if one technology fails to provide the desired connectivity.

From the above table, the following inferences could be drawn:

1. Most manufacturers provide in-built communication modules. However, plug-in/modular modules and external are also provided by some manufacturers.
2. Barring a few manufacturers, all provide a single communication module in their smart meter (not counting the communication module for the optical and electrical ports).

3. Apart from offering proprietary solutions, 6LoWPAN, ZIGBEE and PLC are the other common technologies that are offered by the manufacturers for providing a Field Area Network (FAN). However, a few manufacturers offer GPRS, HSPA, LTE and IEEE 1901.2.
4. GPRS is the most common technology offered for providing a Wide Area Network (WAN). However, some manufacturers use wired media such as optical fiber and copper cables, and wireless media such as WiMax, LTE and HSPA for providing a WAN.
5. ZigBee is the most common communication technology provided by the manufacturers for providing a Home Area Network (HAN). However, other RF technologies, such as 6LoWPAN and Wi-Fi, and wired media, such as PLC and Wi-Fi are also offered by them.

3.3.2 Part 2: Ports

Table 2: Results of survey - Part 2: Ports

Meter Manufacturer	Electrical port for remote access	Optical port for local access	Any other port
M1	No, PLC/RF Mesh/GPRS/HSPA is used for remote access	No, PLC/RF Mesh/Wi-Fi is used for local access	Wireless M-Bus option for multi-utility services
M2	RS 232 or	Yes	No
	RS 485		
M3	RS 232 or	Yes	No
	RS 485		
M4	RS 232 with RJ 11	Yes	No
M5	RS 232 or	Yes	Hard-wired RS 232
	RS 485		
M6	RS 232 or	Yes	No
	RS 485		No
M7	RS 232	No	No
M8	RS 485	No but can be provided. IR port is available for local access	IR port for local access
M9	RS 232 and/or	Yes	No
	RS 485		

From the above table, the following inferences could be drawn:

1. Most of the manufacturers provide either a RS 232 or a RS 485 port for remote access.
2. Barring two manufacturers, all provide an optical port for local access.

3. Apart from the above mentioned ports, some manufacturers also provide a hard-wired RS 232 port, an IR port or a port for wireless M-Bus.

3.3.3 Part 3: Standards/Protocols

Table 3: Results of survey - Part 3: Standards/Protocols

Meter Manufacturer	Applicable standards	Metering protocol used
M1	IEC 62052, IEC 62053, IEC 62056/DLMS Series IEC 61000-4-2 IEC 61000-4-4	IEC 62056-1-0
M2	IS 13779, IS 15884, IS 15959	DLMS
M3	IS 15884	DLMS on optical port
		Proprietary protocol for Low Power Radio
		ZigBee for HAN
M4	IS 13779	DLMS for 3 phase meters
		ZigBee SEP for single phase
		ModBus for single phase
M5	IS 13779, IS 15884, IS 15959	DLMS
M6	IS 13779, IS 15884 and IS 15959	Depends on application - DLMS or proprietary
M7	IEC 62053	DLMS
M8	IS 13779 and IS 14697	DL/T 645-2007
M9	IS 15884, IS 15959	DLMS
		Proprietary (as defined by the utility)

From the above table, the following inferences could be drawn:

1. IS 13779, IS 15884 and IS 15959 are followed by most manufacturers.
2. Most manufacturers use DLMS/COSEM as the metering protocol. However, ModBus, ZigBee and proprietary protocols are also used by some manufacturers.
3. There is no uniformity in the use of these standards, as currently there is no Indian standard for smart meters and AMI. BIS is in the process of formulation of these standards.

3.3.4 Part 4: Power Consumption

Table 4: Results of survey - Part 4: Power Consumption

Meter Manufacturer	Power consumption of meter excluding the communication module and connect-disconnect switch	Power consumption of the communication module/s	Power consumption of the connect/disconnect switch
M1*	-	4W - PLC and RF modules	-
		1W - RF only	
		3W - GPRS and HSPA modules	
M2**	<8VA, 1.5W	-	-
M3	<8VA, 1W	Max 2W	2-3 W during transition
M4	<8VA, 1.5W	0.35W - ZigBee	<1.5 W
		Around 0.15W – Proprietary RF	
M5	1W and 10 VA	1.5W - GPRS	1W
		1W - RF	
		1W - PLC	
M6***	0.7W	-	-
M7	2W	-	-
M8	Voltage circuit - 1.01W and 2.02VA	Voltage circuit - 0.52W and 0.23VA	-
	Current circuit - 0.310VA	Current circuit - 0.010VA	
M9****	<0.5W, 4VA	1.5W, 4VA - RF module	-

* Around 6W for the entire smart meter (metrological section + communication module + remote connect/disconnect switch)

** Around 3W, 10VA for the entire smart meter (metrological section + communication module + remote connect/disconnect switch)

*** 1.5W for the communication module and the remote connect/disconnect switch

**** 2W, 4VA for the communication module and the remote connect/disconnect switch

From the above table, the following inferences could be drawn:

1. Most manufacturers follow IS 13779 for deciding the power consumption of the metrological section of the meter, in which a maximum value of 1.5W and 8VA is mentioned.
2. For all manufacturers, the power consumption of the PLC communication module was the higher (if not same) than that of the RF module.
3. Many manufacturers follow IS 15884 for deciding the power consumption of the connect/disconnect switch.

4. Conclusion

Meter manufacturers in India are doing a tremendous job in transforming the vision of AMI into reality. On the communications front, several technologies are available to them. The type of communication technology to be used in India will depend on the geographical requirements and constraints of specific areas.

It is evident that the meter manufacturers are using current and upcoming technologies in offering smart meters aligned to prevailing standards for metering and communication protocols. So when the ongoing standardisation efforts mature, a unified AMI eco system can be expected to roll out. Therefore it is important for the Bureau of Indian Standards (BIS) to release Indian standards for smart meters and AMI on fast track.

5. References

1. ISGF report on 'Smart Metering Scenario in India' - http://indiasmartgrid.org/en/resource-center/Reports/ISGF_Report%20on%20Smart%20Metering%20Scenario%20in%20India.pdf

2. https://m2m.telefonica.com/m2m-media/m2m-news/item/630-m2m-800-million-electric-smart-meters-to-be-installed-globally-by-2020