18 - Utility Metering Requirements
354th Civil Engineering Squadron
OPR: CES/CENP
ISSUED: 19 April 2017

Purpose

These standards will serve as the primary utility metering criteria reference documents for services provided by architectural and engineering (A&E) firms and consultants in the development of both design-bid-build and design-build contracts. This document is not intended to be used in lieu of detailed design documents in the procurement of facility construction. No part of this document should be considered inclusive to all government requirements.

1. Electrical Metering

1.1. Electrical metering will be accomplished with programmable electronic meters that meet all of the Energy Policy Act of 2005 and Energy Independence and Security Act of 2007 advanced metering requirements. All meters will be capable of communicating information to a standardized data collection system and conform to Unified Facilities Guide Specifications (UFGS), specifically UFGS 26 27 13.10 30.

1.2. All new meters will be one of the following meter forms: 2S for single-phase, and 9S for multi-phase.

1.3. Meter installations that require current transformers (CTs) and voltage transformers (VTs) require the additional installation of test switches to allow for servicing the meters without interrupting building's electrical supply.

1.4. All meters must be factory programmed to begin recording kWh and kW upon installation.

1.5. Meters must have Modbus TCP/IP data output communications capability for Ethernet Network connection to current Eielson AFB automatic meter reading system (AMRS).

1.6. Meters must be installed indoors in electric room and be wired to the base CE vLAN.

1.7. See attached *"AMRS Compatible Devices"* published by AFCEC AMRS group, dated 4 October 2016 for further requirements.

1.8. Electro Industries Nexus 1262 is Eielson AFB's preferred meter. If other meter models are installed, contractor must provide Eielson AFB Energy Manager meter programming software and any meter-specific programming tools.

2. Water and Condensate Metering

2.1. All water and condensate meters will be the recording type.

2.2. All meters will be easily accessible and must have a mechanical odometer- style totalizer on the meter that can be easily read manually. If, because of piping requirements or space constraints, the mechanical totalizer cannot be read easily, the additional installation of a remote read-out will be required. Any remote read-outs must be electrically powered; no battery powered units are acceptable.

2.3. Meters must be installed with by-passes so that they can be removed for maintenance without causing a utility outage to the facility.

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2.4. The condensate meters must be compatible with the chemical composition and temperature of Eielson's condensate and therefore have stainless steel bodies and components.

2.5. The meters must have a pulse or 4 – 20 mA output so that they will be able to communicate with the base AMRS.

2.6. As of this time, Badger Meters have units that are compatible with Eielson's systems.

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ATTACHMENT A

AMRS COMPATIBLE DEVICES
AFCEC AMRS GROUP
4 OCTOBER 2016

AMRS Compatible Devices

1.0 AMRS Electric Meter Specifications

AMRS compatible Electric Meters shall meet the following requirements:

- Current Inputs:
- Nominal 5A (Class 0.2s)
- Measured Current: 50mA to 10A
- Withstand: 20A Continuous
- Poly Phase (3 voltages and 3 currents)
- Internal storage for recording 2 values or channels for 90 days, configurable using manufacturer supplied configuration software. Must support interval consumption (15 minute) and demand (15 minute block average)
- Clear and concise manufacturer's published procedure or method for extracting the internally recorded values, register sets (buffer) or channel data via Modbus and Ethernet
- Shall support time of use recording
- Onboard Ethernet communications, base 10/100 with RJ45 connector or pigtail with receptacle connector
- Modbus/TCP communication protocol is required.
- Front display with ability to display all measured values
- Meter internal real time clock that can be set via the Ethernet network
- Minimum of two external dry contact inputs that shall count pulses from other devices
- Minimum of one (1) external RS485 serial port
- The above requirements are for new, electric meter installations.

1.1 New Meter Installations

All new meter installations, shall be provided with voltage and current safety disconnect devices or equivalent, so that the meter assembly can be worked on safely over the life of the meter installation and not require utility outages for servicing. All new meter installations shall include the installation of new properly sized split or solid core current transformers (CTs).

1.2 AMRS Compatible Meter List

The following list of meters were evaluated, meet the AMRS meter specification and are compatible within the AMRS platform and meet cybersecurity requirements:

- Electro Industries Nexus 1262 ← Preferred model for Eielson AFB
- Electro Industries Nexus 1272
- Electro Industries Nexus 1500+
- Schneider Electric PM850SD
- Schneider Electric PM5560
- Schneider Electric PM8000
- Schneider Electric ION 8650

1.3 AMRS Non-Compatible Electric Meter List

In general, all meters using ANSI C12 communication are not compatible with the AMRS platform and have exhibited cyber vulnerabilities. Meters using ANSI C12 communication shall not be used on AF installations.

The following meters were evaluated, they are not compatible with the AMRS system and do not meet cybersecurity requirements:

- Elster A3 ALPHA
- Itron CENTRON

2.0 AMRS Compatible Gas Meter Specifications

AMRS compatible gas metering solutions consist of a componential system to achieve the goal of delivering gas consumption data into the AMRS. To accurately scale output pulses the contractor shall obtain building gas usage from base personnel, taking into account peak demand when sizing the components that are necessary as well as determining peak pulse rate as to not saturate the receiving device and risk losing captured pulse data. The various components that may be necessary include but are not limited to the following: Gas Meter, Pulse Kit, High Speed Dividing Pulse Relay, Accumulator, Electric Meter with digital input availability.

- Pulse kit must be able to produce a two-wire (Form A) pulse output
- Pulse output shall be delivered to a high speed dividing pulse relay that has the capability of producing a wetting voltage if necessary
- High speed dividing pulse relay shall provide isolated pulse outputs (Form A) that shall be delivered to an AMRS compatible electric meter
- In the event a facility does not have a compatible AMRS electric meter a high speed dividing pulse relay shall provide isolated pulse outputs (Form A) that shall be delivered to an accumulator that speaks the Modbus protocol natively and can communicate to AMRS via the Modbus/TCP protocol
- Gas Meters that can communicate to AMRS via the Modbus/TCP protocol may be acceptable if they can pass technical and cybersecurity evaluations directed by the AMRS PMO. At this time there are no tested or approved Modbus /TCP gas meters

3.0 AMRS Compatible Translation Devices and Accumulators

3.1 The following devices are compatible with the AMRS platform, are consistent with the need of the existing site conditions, have been tested and passed cybersecurity requirements:

- Advantech ADAM-6051 I/O Modbus TCP Module with firmware v5.04 B01
- Perle IOLAN SDS1P Serial to Ethernet Device Server with firmware v4.6 F1

3.2 The following device was evaluated and is not compatible with the AMRS platform, and is not cyber secure:

- Perle IOLAN DS1 Serial to Ethernet Device Server

4.0 Typical AMRS Electric Meter Profile

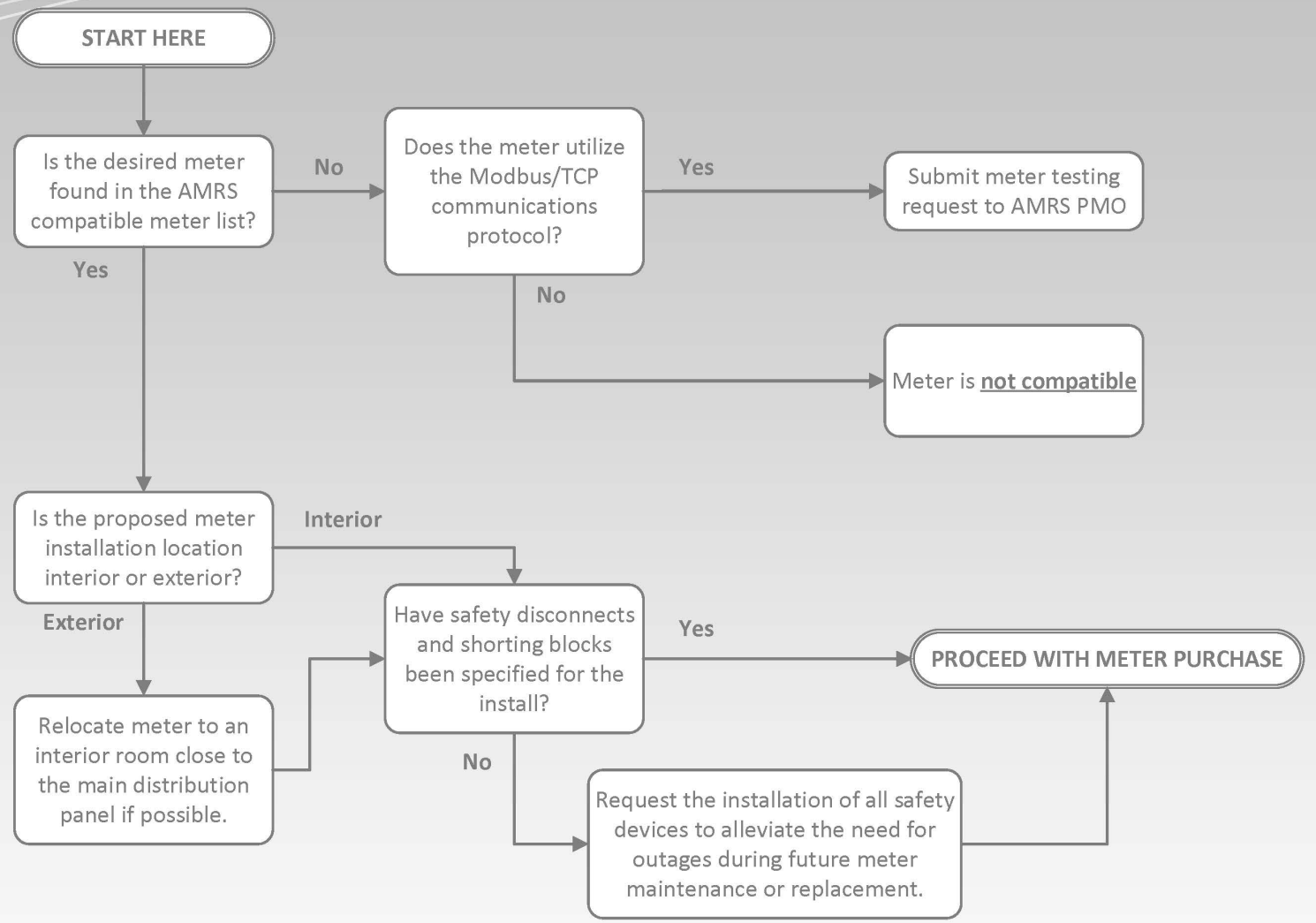
Measured Parameter	Meter-Typical	AMRS Namespace
Voltage Phase A-N or A-B, Typical settings	Volts AB	VOLTS_PH_AB
Voltage Phase B-N or B-C, Typical settings	Volts BC	VOLTS_PH_BC
Voltage Phase C-N or C-A, Typical settings	Volts CA	VOLTS_PH_CA
Current Phase A	IA	CUR_PH_A
Current Phase B	IB	CUR_PH_B
Current Phase C	IC	CUR_PH_C
Current Phase N, Neutral, Calculated	INc	CUR_NEUT
Power (Real) or Active, Total	Watts Total	PWR_WATTS_POLY
Power Reactive, Total	VAR Total	PWR_VAR_POLY
Power (Volts Amps) or VA, Total	VA Total	PWR_VA_POLY
Power Factor Total, COS	PF	PF_POLY
Frequency in HZ	Frequency	FREQ
Demand, Block Average (15 Minute) (BWA) (Wright Pat 30 Min)	KW	DEMAND_KW
Energy, KWH (Active or Real)	WH Quadrant 1 or (1+4)	ENERGY_KWH
Pulse Aggregation, Unscaled	Aggregator 1	Pulse_1_raw
Pulse Aggregation, Unscaled	Aggregator 2	Pulse_2_raw
Pulse Aggregation, Unscaled	Aggregator 3	Pulse_3_raw
Pulse Aggregation, Unscaled	Aggregator 4	Pulse_4_raw

5.0 Typical Stored Data

Measured Parameter	Meter-Typical	AMRS Namespace
Consumption Interval (15-minutes)	Interval	Calculated (delta value Internal to CEM object)
Demand	Block Average	Calculated (total and peak)

6.0 Electric Meter Decision Flow Chart

AMRS compatibility guide: Electric Meters



What is an AMRS compatible meter?

An AMRS compatible meter is a meter that has been tested thoroughly in the AFCEC AMRS meter lab. Tests include the following: communication protocol compatibility, meter data point analysis and data extraction, cyber security testing and configuration baseline development.

Make	Model	Mount
Schneider	PM8000	Surface
EIG	Shark 1500	Surface
Schneider	PM5560	Surface
EIG	Shark 200	Surface
Schneider	ION 8650	9S
EIG	Nexus 1262/1272	9S
EIG	Shark 270	9S

*as of September 01, 2016

Disconnects and Shorting Blocks

The use of Shorting blocks and Fuse Block Disconnects are required to ensure safety when working with electric meters. The implementation of these devices during installation will alleviate future building power outages due to meter maintenance or replacement.

CT Shorting Blades

Fuse Block Disconnect

Form 9S Meters and Surface Mount Installation

The AMRS PMO has determined interior locations for electric meters will lower life cycle sustainment costs and extend meter life expectancy for various reasons which include: physical security for the electric meters, reducing the need to extend communication outside the building thus eliminating a cyber-security concern, protecting the meter from the elements. In the event that relocation isn't feasible and an existing meter enclosurecontains safety disconnects and a shorting block, a Form 9S meter may be specified.

Form 9S base

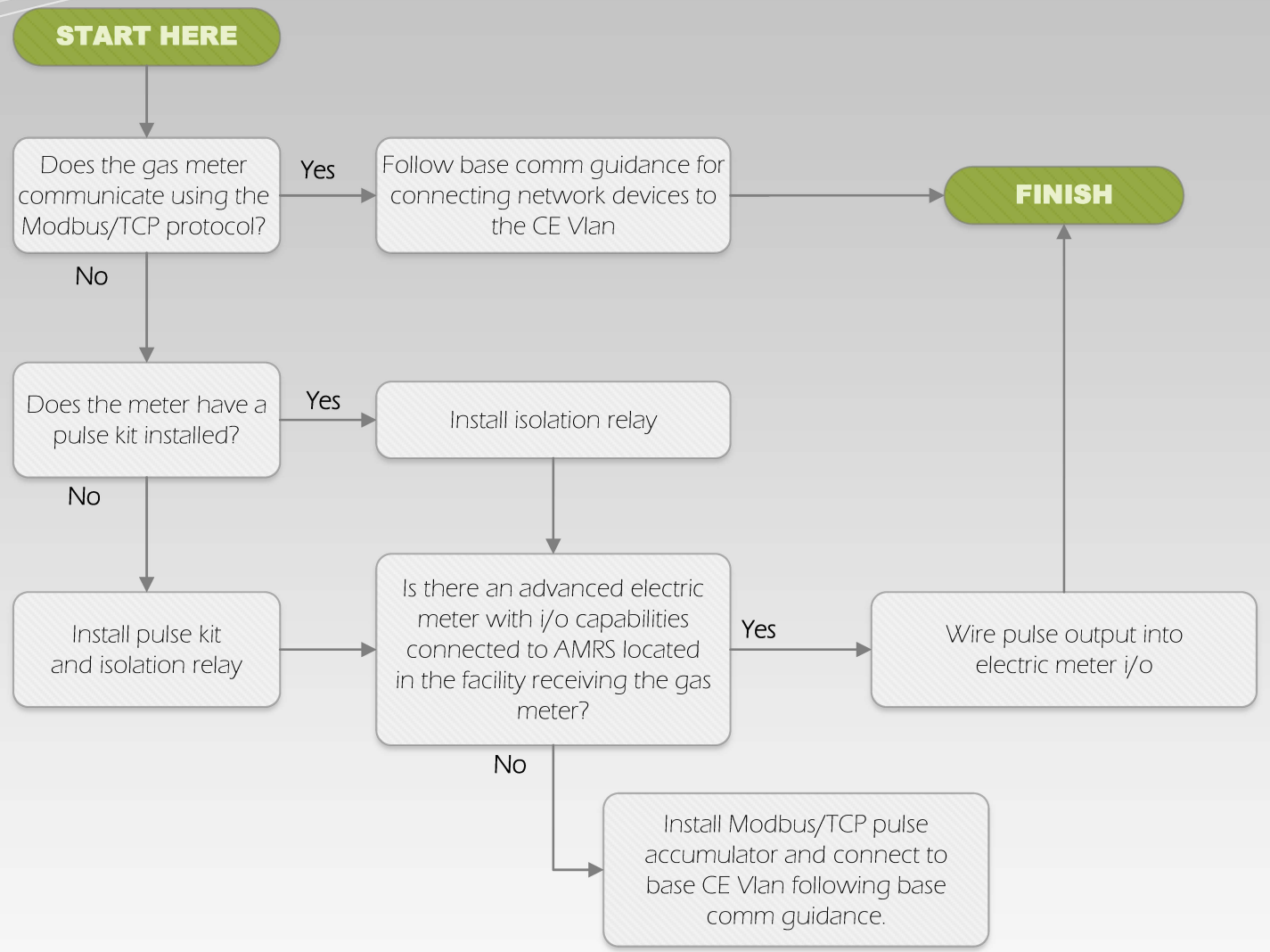
Surface Mount

What is the Modbus/TCP communication protocol?

The Modbus/TCP communication protocol is the standard for AMRS due to it being openly published and royalty free as well as having a very broad acceptance in industrial environments. This protocol also enables AMRS and EMCS systems to poll electric meters for data simultaneously.

7.0 Gas Meter Decision Flow Chart

AMRS compatibility guide: Gas Meters



AMRS compatible pulse accumulators and isolation relays.

An AMRS compatible pulse accumulator is a device that has been tested thoroughly in the AFCEC AMRS meter lab. Tests include the following: communication protocol compatibility, cyber security testing and configuration baseline development.

Make	Model
Adams	6051
Acromag	989EN-4016
SSI	PMC-1
E-mon	EIDR

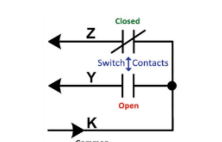
An isolation relay is a device that should accept a form A or C pulse and filter noise to prevent noise from triggering a false output, the isolation relay should also have a fused output to offer protection from lighting or transient voltage damage

*as of September 01, 2016

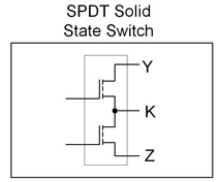
What are KYZ pulses?

KYZ pulses are used to transmit instantaneous gas consumption information from the gas meter to another piece of equipment. The downstream (receiving device) may be a pulse accumulator, an electric meter, a data acquisition server, etc. A KYZ interface (SPDT) includes two switch contacts; Y and Z. The electric current travels/ toggles between K and these two switch contacts (Y and Z) changing from one state to another. A pulse is defined as this change of state, and represents some amount of flow that has gone past the meter, or in other words, consumed by the customer.

When consumption is high the speed of switching from K – Y to K – Z increases, and as consumption declines the switching slows. While the speed of switching increases and decreases with consumption, the duty cycle (time each switch is closed) is always approximately 50/50; meaning that each side's on and off times are the same. This provides a universal way to record and transmit gas usage information.



SPDT Solid State Switch



AIR FORCE CIVIL ENGINEER CENTER
ADVANCED METER READING SYSTEM