101 BASICS SERIES

LEARNING MODULE 11: METERING

Cutler-Hammer

EATON

WELCOME

Welcome to Module 11, which is about metering. *Meters* are devices used to measure power usage.

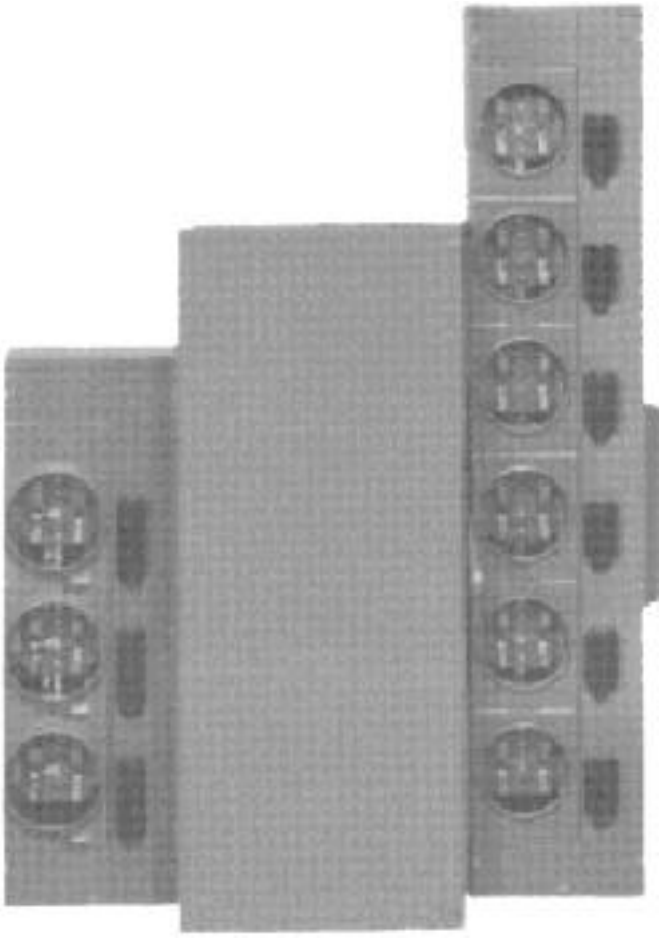

FIGURE 1. TYPICAL METER CENTER

Like the other modules in this series, this one presents small, manageable sections of new material followed by a series of questions about that material. Study the material carefully, and then answer the questions without referring back to what you've just read.

You are the best judge of how well you grasp the material. Review the material as often as you think necessary. The most important thing is establishing a solid foundation to build on as you move from topic to topic and module to module.

A Note on Font Styles

Key points are in bold.

Glossary terms are underlined and italicized the first time they appear.

Viewing the Glossary

You may view definitions of glossary items by clicking on terms and words that are underlined and italicized in the text. You may also browse the Glossary by clicking on the Glossary bookmark in the left-hand margin.

WHAT YOU WILL LEARN

We'll **step through each of these topics** in detail:

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INTRO-DUCTION

When dealing with an electrical distribution system. There needs to be some way to measure the power going into a residence or building. The utility company does not allow for unmetered power to be used. Consequently, every *service entrance* needs a separate meter for accurate billing of power consumption.

What is a Meter?

A meter is the device used to measure this power. The unit of measurement is the *watt/hour*. For this reason it is typically called a *watt/hour meter*.

FIGURE 2. TYPICAL WATT/HOUR METER

Components of a Meter

There are three main components to a meter. These are the *measuring device*, the *meter socket* and the *jaws*.

The measuring device itself is typically supplied by the utility company.

It was once common practice for the local utility to also provide the meter socket, but that is no longer true for a growing number of geographical regions of the country. **In many cases, providing the meter socket is now the job of the electrical contractor.** The meter socket is the receptacle for the meter. It also provides the structural support and electrical connection for the meter. This socket must meet stringent utility specification for use with the utility's meter.

The meter is clamped into place by a set of four jaws. The jaws grip the blades in the base of the meter. The jaws also prevent unauthorized tampering with the meter. In some cases, a fifth jaw is required.

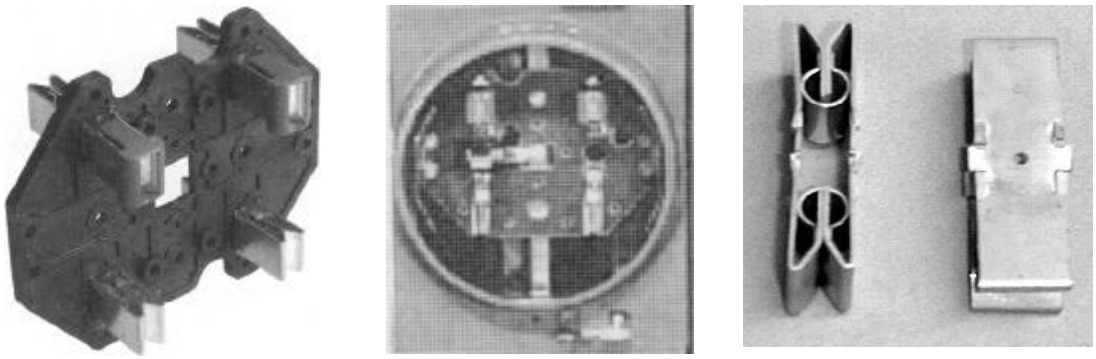


FIGURE 3. (LEFT TO RIGHT) TYPICAL METER SOCKET BASE, METER SOCKET, JAWS

What is a Watt/Hour?

The watt/hour is a standard unit of measurement for electrical power usage. **One watt/hour is literally the use of one watt of electricity in one hour.**

This is a pretty small amount of electricity. Consider a typical 75-watt light bulb used in a common household table lamp. If that lamp is left on for one hour, it will consume 75 watt/hours of electricity. Now consider all the electrical devices in the average home. The number of watt/hours consumed begin to add up quickly!

For this reason, **quantities of electrical power are generally referred to in kilowatt/hours.** A *kilowatt/hour* is simply 1,000 watt/hours.

IN THE WORKPLACE

Each of these watt-hour meters is tracking the power consumption in one living unit of this multi-family building.

This allows the utility company to bill the occupant of each living unit directly, instead of sending one bill to the building owner.

WATT/HOUR METERS

TYPES OF METERING SYSTEMS

There are three types of meters:

- Single Socket
- Meter-Breaker
- Multiple Metering

Single Socket

Single socket devices are used quite commonly in single-service applications. For new home construction, if local codes will not allow use of the *meter-breaker*, a single meter socket will be required.

Meter-Breaker

A meter-breaker is a device containing a single meter socket, a *tenant main disconnect*, and a *distribution section* for *branch circuits*. Essentially, it is a single meter socket and a *loadcenter*, combined into one rainproof enclosure for convenience. **The use of the meter-breaker offers significant advantages over the single meter socket.**

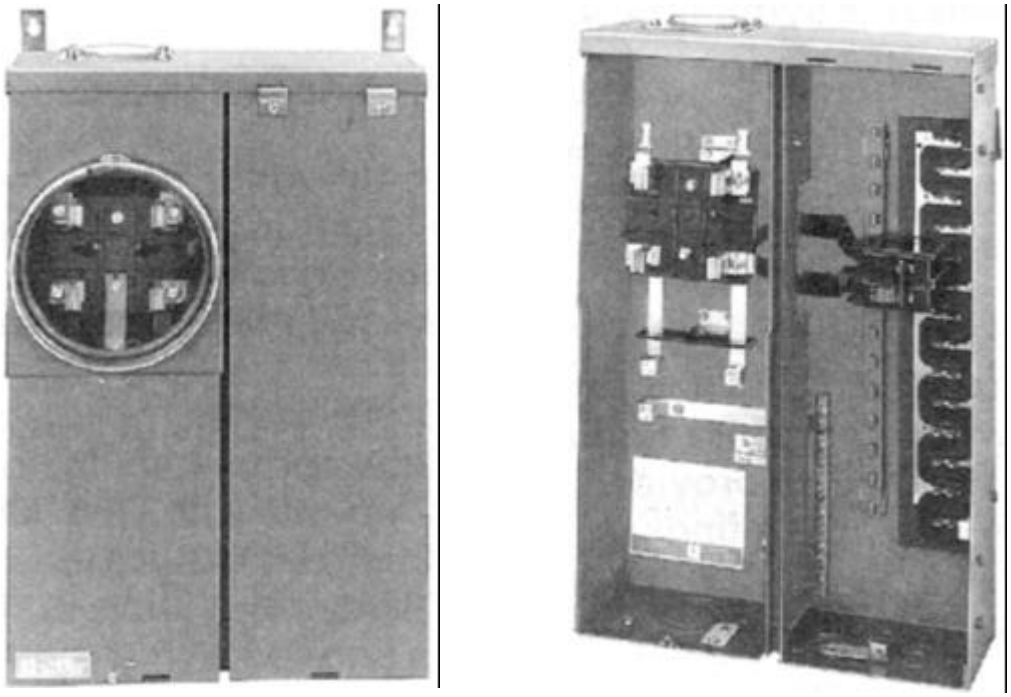


FIGURE 4. TYPICAL METER-BREAKER: COVER PLATES ON (AT LEFT) AND OFF

Meter-Breaker (continued)

Meter-breakers are commonly used in applications such as:

- Residences
- Rural service entrances
- Mobile homes
- Temporary power on construction sites

Features of a typical meter-breaker include:

- Adaptable for overhead or underground service
- Meets NEC (National Electrical Code) wire bending requirements
- Fifth jaw position
- Semi-flush or surface mounting *NEMA* Type 3R enclosure
- Meter socket compatible with locking security rings
- Molded bus supports for rigid construction and security of *bus bars*
- Lockable cover on distribution section for security
- Used with single-phase, three-wire, 120/240 volt system

The use of the meter-breaker originated on the west coast. It has also been approved for use in Florida, Georgia, New Jersey, Mississippi and Puerto Rico.

Multiple Metering Systems

Using single socket devices in combination for a multi-tenant application is very labor-intensive. Cables must be run into each device and through a wiring trough to each individual loadcenter.

In such cases, it is much less complicated to use one of two *multiple metering systems*. These are:

- *Meter pack* – Self-contained, meter centers for up to 6 tenant meters.
- *Meter center* – Custom-configured for each job, comprised of a main disconnect, meter socket and cabling components.

Since meter packs and meter centers are more complex systems, we will be concentrating on them in more detail in the following sections. We will begin with meter packs.

METER PACKS

A meter pack, also called an *all-in-one*, is a stand-alone that contains the following components:

- a service termination point
- two to six 125-amp or 200-amp meter sockets with branch circuit protection
- connection provisions for cabling out to each tenant

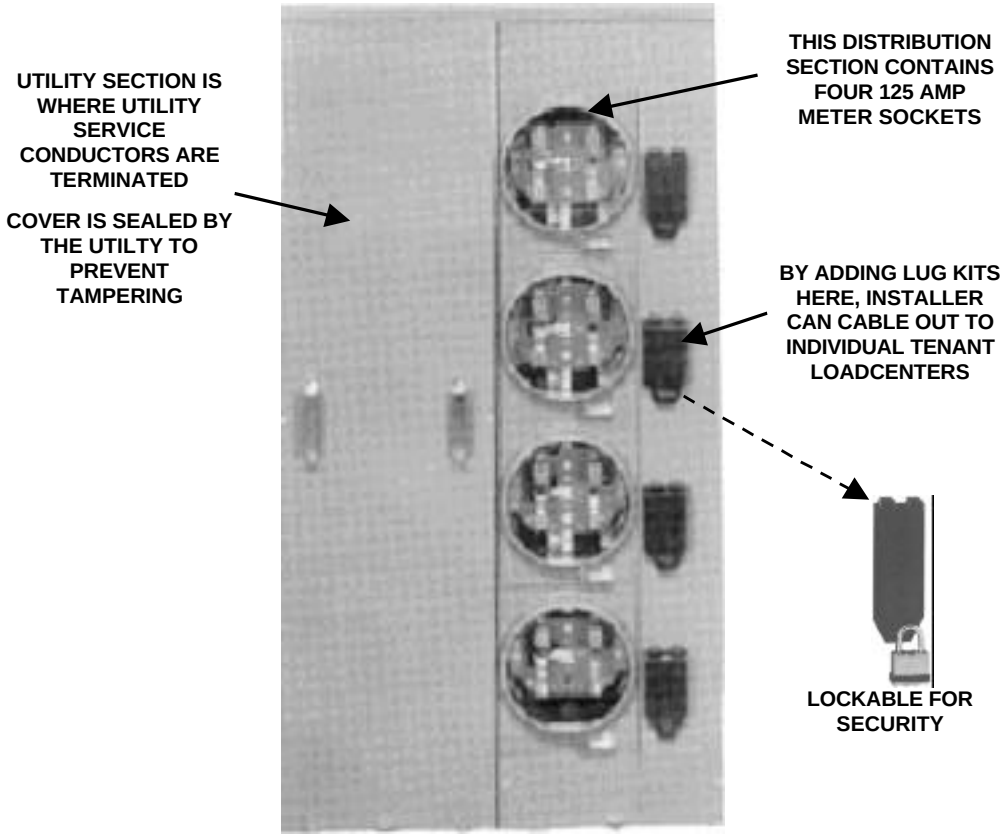


FIGURE 5. TYPICAL METER PACK

Features

Meter packs are UL listed for a Service Entrance. It is available with a maximum of six meter sockets. This is based on the NEC *Six Handle Rule*. This ruling states that **you must be able to throw no more than six handles into the off position to disconnect electrical service.**

In other words, the meter pack can contain up to six meter sockets without the need for an upstream main disconnect. To comply with this ruling as economically as possible, meter packs are only manufactured with a maximum of six meter sockets.

The enclosure for the meter pack is typically a NEMA Type 3R. This enclosure type can be used outdoors or indoors, and it is suitable for surface mounting. It is also padlockable.

Meter packs can handle up to 600 amps and 240 volts. They are used with single phase metering on 120/240V and 208Y/120V systems.

The tenant *main breakers* are two *pole* breakers from 40 to 200 amps, with up to 100,000 *amps interrupting capacity* (AIC) protection.

Applications

Applications for meter packs include condominiums, apartment buildings, and multiplexes. When a complex exceeds six units, the utility must be willing to provide additional drops. If they are not willing to do so, a meter center must be used.

METER CENTERS

A meter center is a more advanced, modular metering system. It is used in both residential and commercial applications as service entrance equipment.

A meter center is composed the following components:

- A main disconnect or service main (called a *main service module*)
- One or more *metering stacks*
- Cabling components that are custom configured for each job

Figure 6 shows a typical meter center.

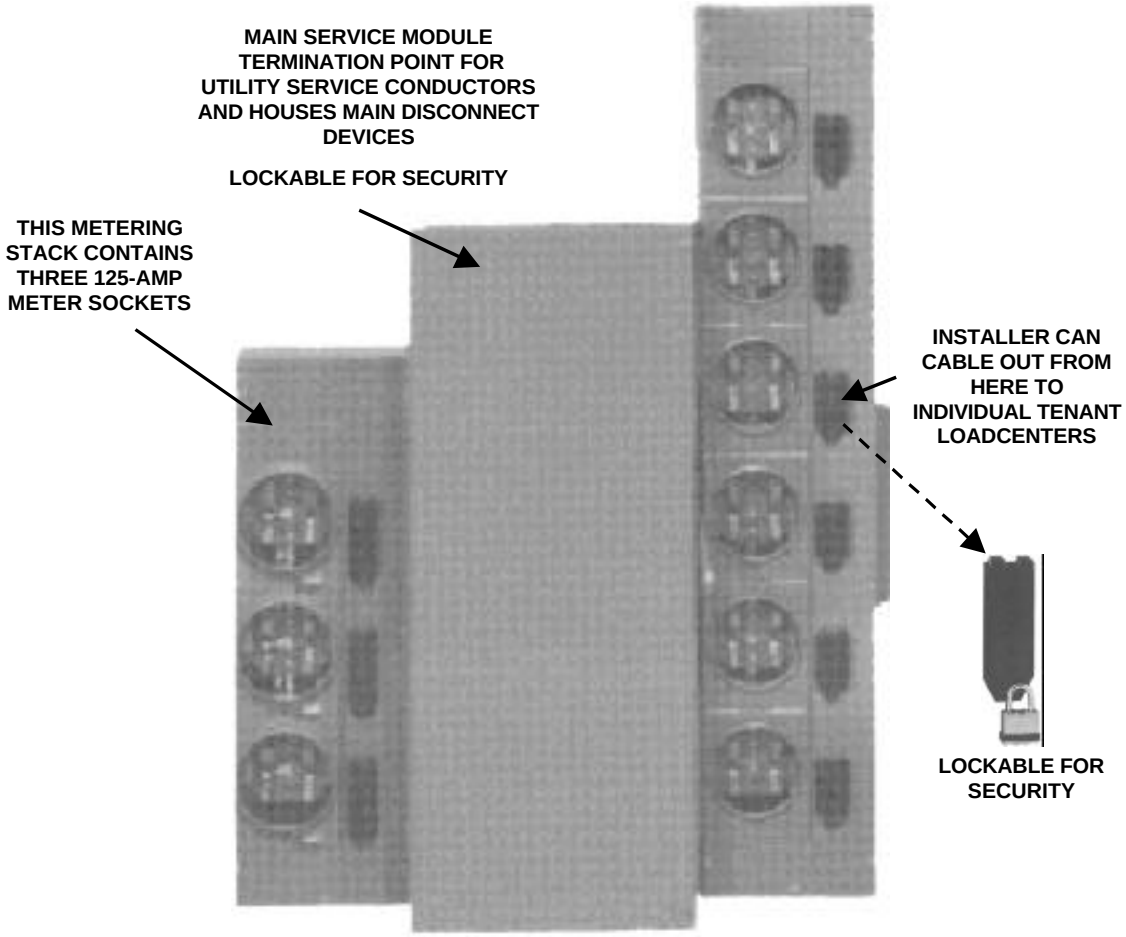
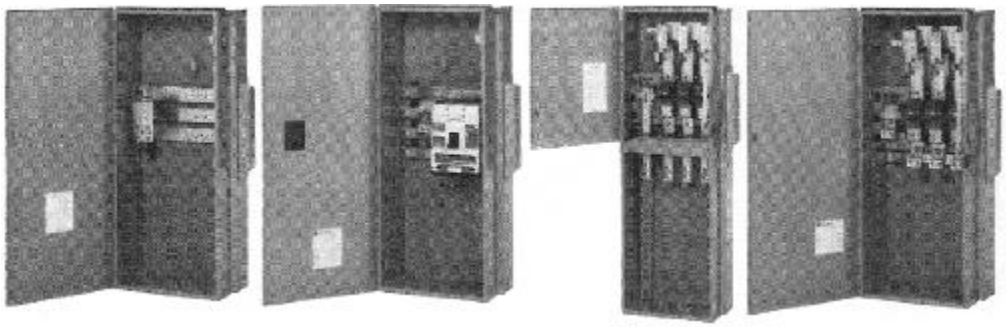


FIGURE 6. TYPICAL METER CENTER

Main Service Module

The main service module provides a utility service termination point. But it **also contains a means of disconnection for the tenant mains.** This comes in the form of bussed *circuit breakers*, *fusible switches* or *main terminal boxes*. Disconnects are available in single-phase and three-phase. Below are the typical applications of the listed disconnect devices:

Service	400 Amps	600 Amps	800 Amps	1200 Amps	1600 Amps	2000 Amps
Disconnect Devices	Fusible Switch Molded Case Circuit Breaker Main Terminal Box	Fusible Switch Molded Case Circuit Breaker Main Terminal Box	Fusible Switch Molded Case Circuit Breaker Main Terminal Box	Bolted Pressure Switch Molded Case Circuit Breaker Main Terminal Box	Bolted Pressure Switch	Bolted Pressure Switch



MAIN TERMINAL BOX | **MAIN CIRCUIT BREAKER** | **MAIN FUSIBLE SWITCH WITH PULL BOX** | **MAIN FUSIBLE SWITCH**

FIGURE 7. AVAILABLE MAIN SERVICE MODULES

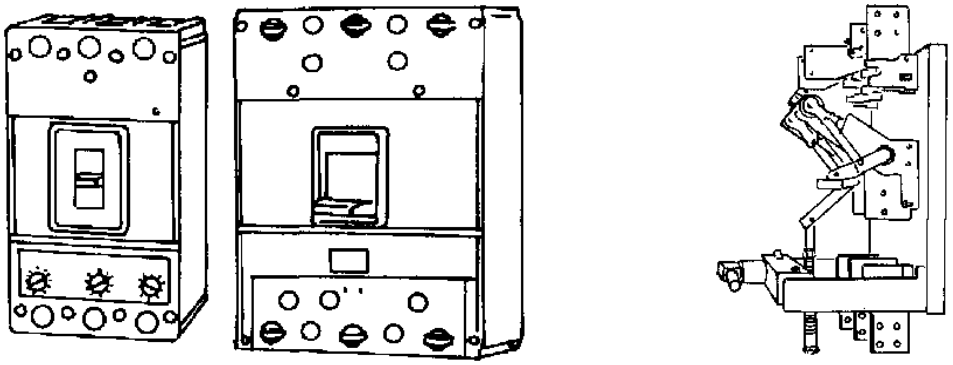


FIGURE 8. TYPICAL MOLDED CASE CIRCUIT BREAKERS (LEFT) AND BOLTED PRESSURE SWITCH

Single-Phase vs. Three-Phase

We have made mention of single-phase and three-phase disconnects without really discussing what is meant by these terms.

Most homes have a 120/240-volt, single-phase, three-wire system. Two of these wires, called *main service conductors* (or “mains”), are ungrounded (“hot”), and the third is the neutral. If a *voltmete*r reading is taken between the two hot conductors, it will measure 240 volts. If a reading is taken between a hot conductor and the neutral, it will measure 120 volts.

Most commercial and light industrial buildings have a 120/208-volt, three-phase, four-wire system. Three mains are “hot,” and designated as Phase A, Phase B, and Phase C. The fourth is the neutral. If a voltmeter reading is taken between any two hot conductors, it will measure 208 volts. If a reading between any hot conductor and the neutral is taken, it will measure 120 volts.

Metering Stack

A metering stack is similar to the distribution section of a meter pack. **It consists of one to six meter socket positions, vertically mounted in a single enclosure.**

Because metering stacks are modular in design, **any number of metering stacks can be ganged together.** They include bus assemblies that can be lined up and bolted together. This creates a network of meter sockets utilizing a single service drop.

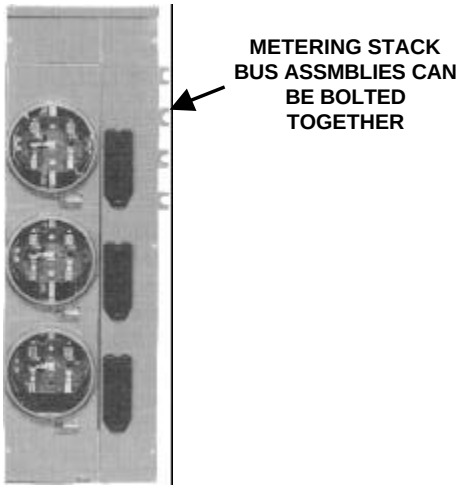


FIGURE 9. TYPICAL METER-STACK

Each meter socket has a provision for tenant branch circuit protection, utilizing either *plug-in* or *bolt-on* breakers. Breakers are available from 40 to 200 amps, with 10,000, 22,000, 42,000 or 100,000 AIC.

Enclosures are typically available in NEMA Type 1 (Indoor) and NEMA Type 3R (Outdoor).

Installation

Most mains and stacks align on the bottom. Many contractors simply run two 2x4's horizontally on the wall, and then set each stack and main on the top edge.

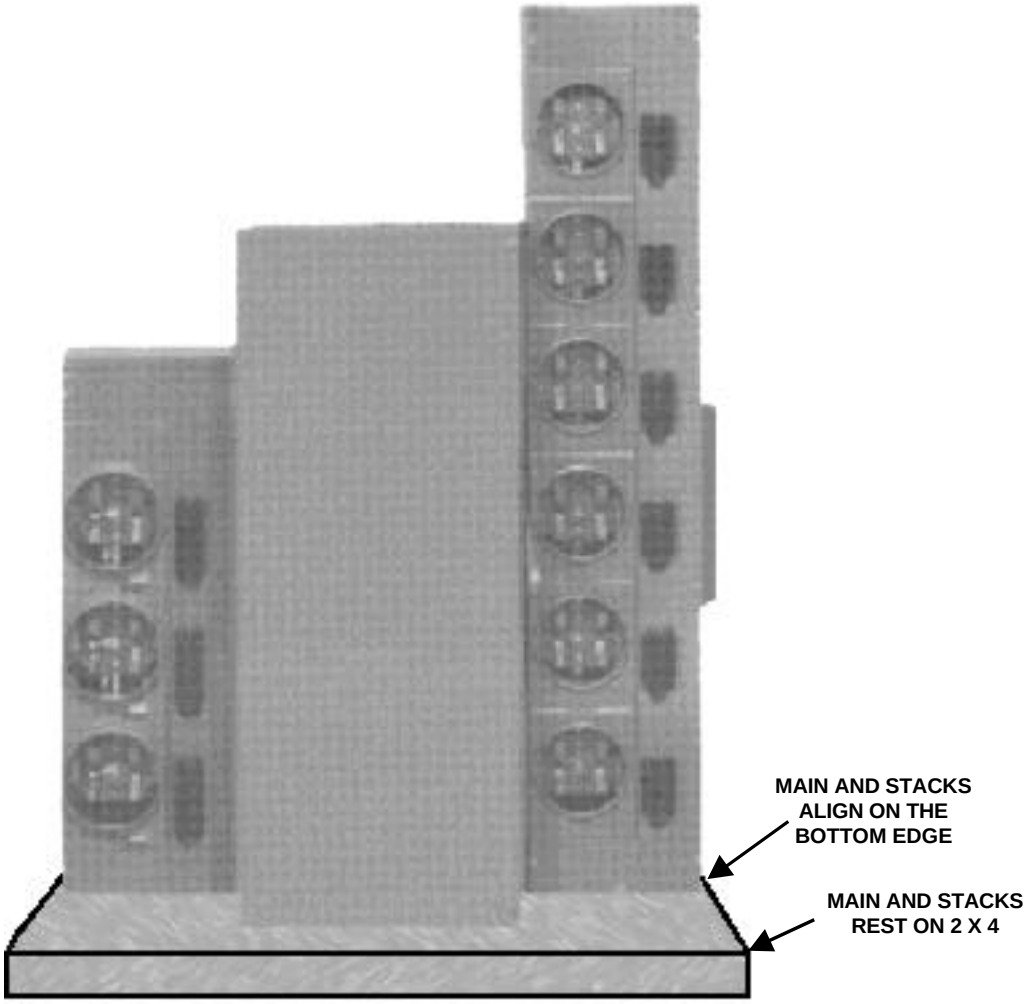


FIGURE10. MOST MAINS AND STACKS ALIGN ON THE BOTTOM

Features

As was mentioned earlier, meter centers are available for residential and commercial applications. Because the two device types are tailored for their intended applications, their features vary somewhat.

We will look at features of residential and commercial meter centers in the next section.

REVIEW 1

Answer the following questions without referring to the material just presented.

1. The _____ is a standard unit of measurement for electrical power usage. One unit is represents the use of _____ of electricity in _____.

2. A meter-breaker is a _____ and a _____ combined into one rainproof enclosure for convenience.

3. Name four common applications for a meter.

   _____

   _____

   _____

   _____

4. The main service module of a meter center can contain four different devices for disconnection the tenant mains. Name three of them.

   _____

   _____

   _____

5. In your own words, explain why metering stacks (and the distribution sections of meter packs) are manufactured with no more than six meter sockets.

   _____

   _____

   _____

   _____

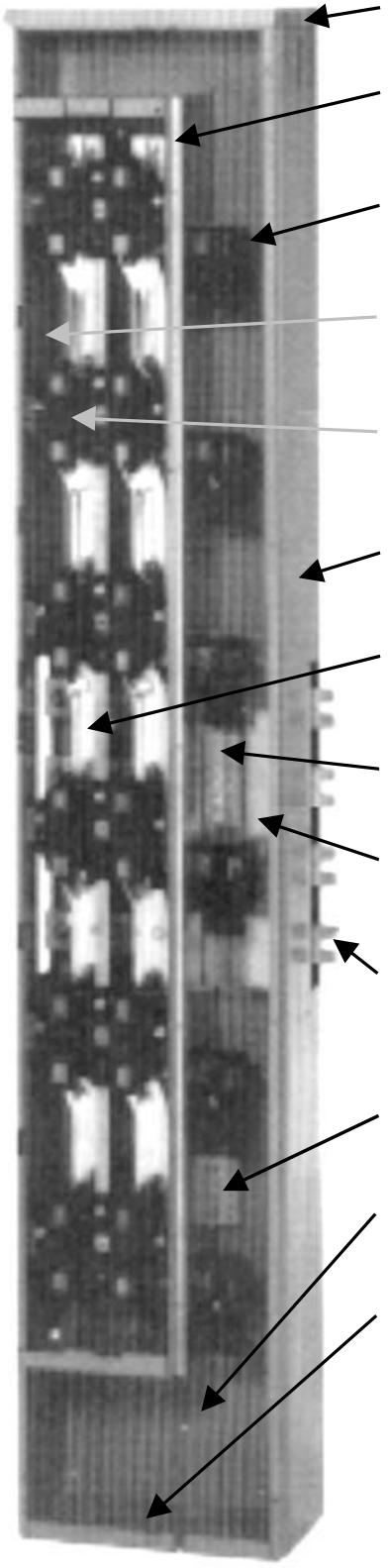
RESIDENTIAL VS. COMMERCIAL METER CENTERS

Residential and commercial meter centers differ somewhat in construction. Let's take a look at some of these differences.

	Residential Meter Centers	Commercial Meter Centers
Applications	Apartments Condominiums Townhomes Strip Malls	Strip Malls Small Office Buildings Light Industrial Parks
Compatible Power Systems	1-phase 120/240V 3-wire	1-phase 120/240V 3-wire 3-phase 208Y/120 4-wire 3-phase 240/120 4-wire delta (through 2000A)
Main Service Module*		
Tenant Mains	Single-phase disconnects only Plug-in or Bolt-on breakers 10, 22 or 42 KAIC protection Covers lockable for security	Single-phase and three-phase disconnects available Plug-in or Bolt-on breakers to 1200 amps, Bolted pressure switches to 2000 amps Up to 100 KAIC protection Covers lockable for security
Metering Stack*		
Common Available Ratings	125 amps, single-phase 200 amps, single-phase 200 amps, three-phase	200 amps, single-phase 200 amps, three-phase 400 amps, three-phase
Number of Sockets	2-6 sockets for 125 amps 2-4 sockets for 200 amps	1-4 sockets
Ganging Stacks	800-amp cross-bus rigid copper or aluminum network	1200-amp cross-bus with *lever bypass*
Meter Sockets	*Ring-type* and *Ringless* styles Ring-type comes with snap-type aluminum sealing rings. Ringless style is available with or without a *horn bypass*.	Ring-type and Ringless styles Ring-type comes with snap-type aluminum sealing rings. Ringless style is available with or without a horn bypass.
Enclosure		
Types	NEMA Type 1 (indoor) with raintight cap NEMA Type 3 (outdoor)	NEMA Type 1 (indoor) with raintight cap NEMA Type 3 (outdoor)
Back Plate	Removable for simplified access	Removable for simplified access
Mounting	Surface Semi-Flush (with mounting kit)	Surface
Concentric *Knockouts*	Available	Not available; too many conduit sizes to accommodate

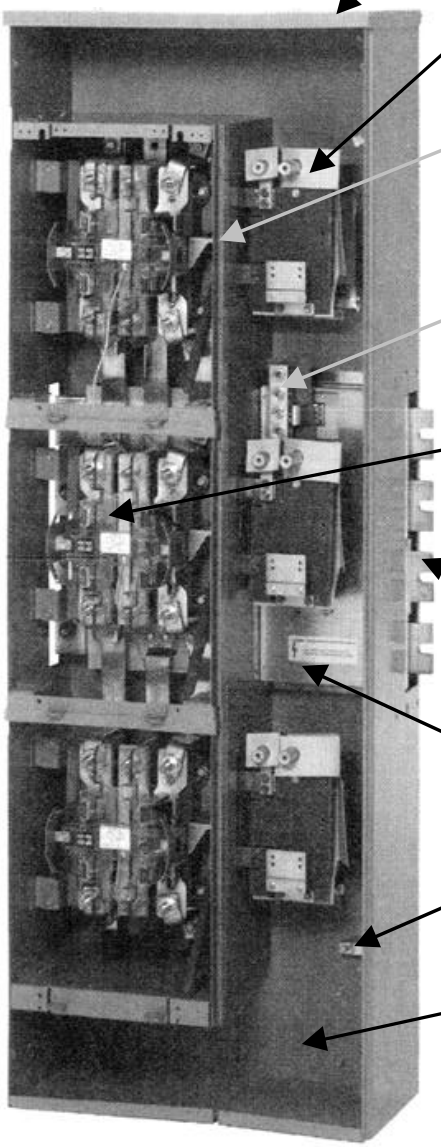
* Can be used in combination with residential main service modules on a single-phase power system.

Residential Metering Stack Features



Raintight Cap	Shipped on each outdoor meter module and main device.
Barrier	Meter socket and tenant main breaker/wireway sections are separated by a solid metal barrier to guard unmetered bus against power theft.
Tenant Breaker	Reliable busbar-to-busbar connection. Accepts bolt-on or plug-in breakers, depending on model.
Vertical Busbar	One-piece vertical busbar from phase balancing joints to meter socket eliminating any chance for hot spots.
Meter Socket	Base is installed without fasteners, reducing chances for hot spots. Easily replaceable, and improves connection to vertical bus.
Superior Finish	Rust inhibiting phosphate primer and gray baked enamel is standard. All outdoor enclosures are of galvanized steel construction.
Moveable Phase Connector	Four-wire horizontal bus lets you use any metering stack for single or three-phase incoming service. Shipped with AB phase connection..
Neutral Assembly	A convenient termination for neutral conductors is in the wireway of each module.
Enclosed Horizontal Bus	Added security. A non- removable barrier exercises the 800 ampere horizontal bus passing through tenant breaker section.
Bus Connection	Mains and modules slip together quickly, smoothly with front- accessible captive bolts securing the junction without removing socket interiors or bus access plate.
Equipment Ground Bar	Factory-installed in side gutter. Moveable to top or bottom gutter.
Removable Backplate	Provides easy rear threading of tenant service cables. One person can thread and hang the module.
Knockouts	Tangential in top and bottom, concentric in removable backplate.
Separate Wireway Cover	Separate covers allow easy access to tenant breaker and wireway section, permitting work on breakers or in wireway without disturbing meters or meter covers. (Not shown.)

Commercial Metering Stack Features



Indoor/ Outdoor Construction

Raintight caps, meter covers and lockable raintight tenant breaker covers make it convenient for you to use any metering stack on either NEMA 1 or NEMA 3R applications.

Tenant Breaker

Reliable busbar-to-busbar connection. Accepts bolt-on or plug-in breakers, depending on model.

Barrier

A solid metal barrier separates the meter socket section from the tenant breaker in the wireway section. The unmetered vertical bus is enclosed to guard against power theft.

Neutral Assembly

Located in the wireway of each metering stack, the assembly permits convenient termination of the neutral conductors.

Meter Socket

5- and 7-jaw meter sockets include built-in *manual bypass* and jaw release. The ground wire is factory connected.

Bus Connection

Mains and modules slip together quickly, smoothly with front-accessible captive bolts securing the junction without removing socket interiors or bus access plate.

Enclosed Horizontal Bus

Non-removable metal barrier encloses 1200-ampere horizontal bus when passing through the tenant breaker section for added security.

Ground Bars

The factory installed equipment ground bars are provided in both the top and bottom gutters.

Removable Panels

The top cap, bottom end wall, and backplate are removable. They do not contain knockouts, so contractors can position and punch holes where they need them.

Separate Wireway Cover

Separate covers allow easy access to tenant breaker and wireway section, permitting work on breakers or in wireway without disturbing meters or meter covers. (Not shown.)

IMPORTANT CONCEPTS

By now, you should be pretty comfortable with both the function and the features of meter centers. But, before you can make a product recommendation to a customer, there are a few other important concepts to consider.

Phase Balancing

First, let's consider the topic of *phase balancing*. This only affects three-phase systems.

Phase balancing refers only to the metering stacks of three-phase systems. All three-phase metering stacks are factory-connected AB. This means that they pull power from the A-phase and B-phase.

When you have a system involving multiple stacks, it is critical to spread the load evenly across the three-phases. This can seriously impact selection of the metering stacks, as we will see in a moment.

Performing phase-balancing in the field for a metering stack is as simple as moving a jumper. Take a look at Figure 11.

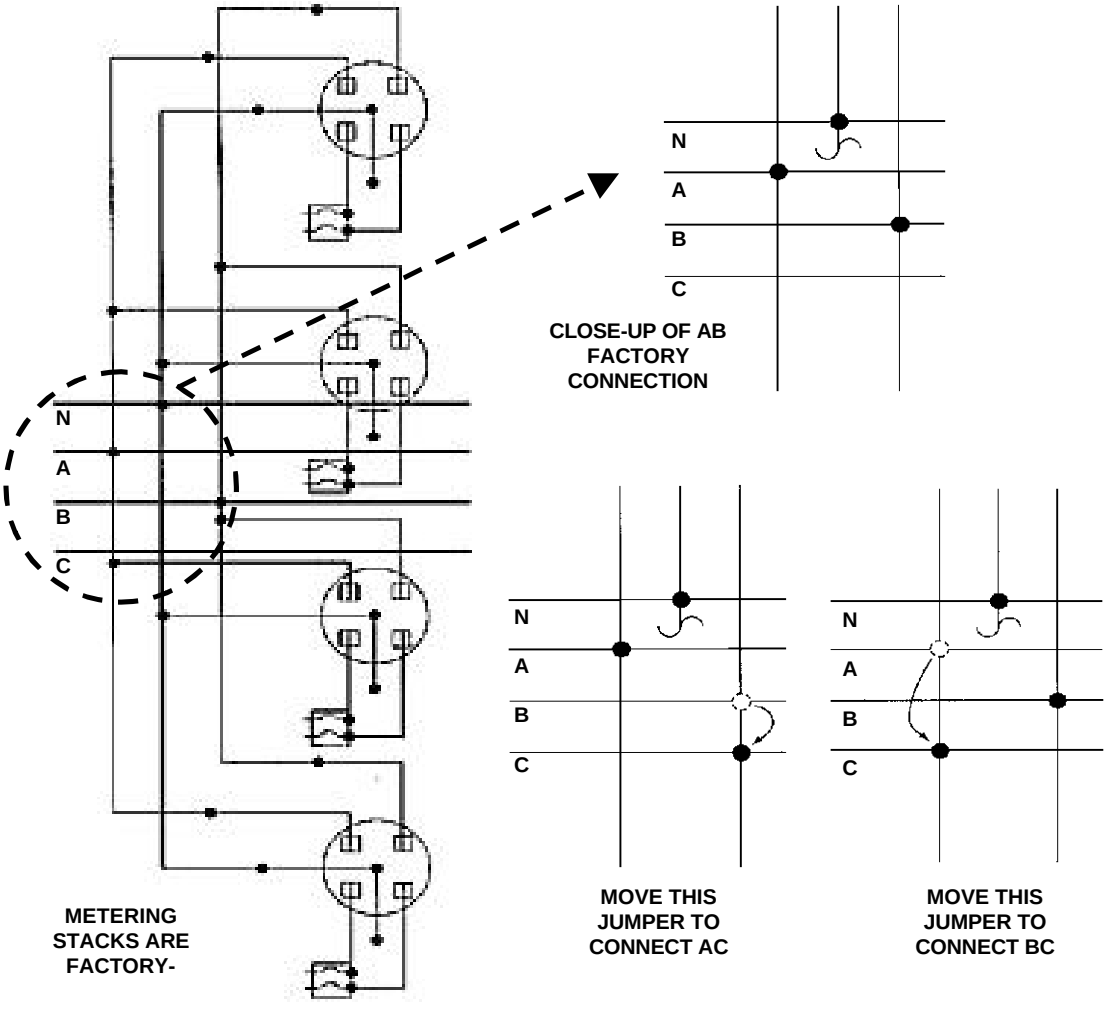


FIGURE 11. PERFORMING PHASE-BALANCING IN THE FIELD

Phase Balancing (continued)

While it may sound like a complex process, physically performing the phase balancing procedure in the field is a simple and quick process.

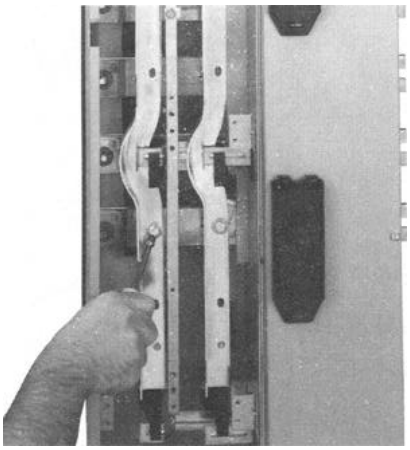


FIGURE 12. PHASE-BALANCING IN THE FIELD

As mentioned earlier, it is critical to “spread the load” amongst the three-phases. This can seriously impact selection of metering stacks. But, there is a simple process for determining which metering stacks to use for any given application.

Let’s look at a few examples.

Example 1: 9 meter socket positions
If phase balancing were not an issue, it would be easy to select two metering stacks: one with four meter positions and one with five meter positions.

But with only two stacks, one of the three poles would be in use by both stacks. Recall that all stacks are factory connected as AB. Suppose you moved the jumper on the five-unit stack to AC. The result would be:

Stack	A	B	C
4-position	4	4	0
5-position	5	0	5
Total meters on phase	9	4	5

This system is out of balance. Instead, select three stacks with three meter positions each. Move one jumper to AC and another jumper to BC. The result would be:

Stack	A	B	C
3-position	3	3	0
3-position	3	0	3
3-position	0	3	3
Total meters on phase	6	6	6

Phase Balancing (continued)

Example 2: 16 meter socket positions
What happens when the number of meter positions isn't divisible by three? It is not possible to perfectly balance the system. The answer is to get as close as possible.

Use two 5-position stacks and two 3-position stacks. Set one 5-position stack to AC and the other 5-position stack to BC. The result would be:

Stack	A	B	C
3-position	3	3	0
3-position	3	3	0
5-position	5	0	5
5-position	0	5	5
Total meters on phase	11	11	10

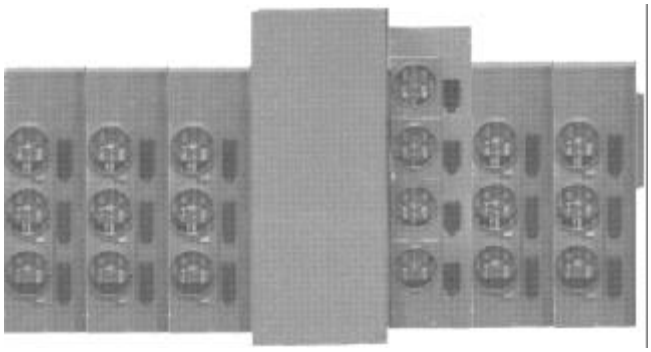
This system is not perfectly balanced, but it is as close as physically possible. The system will not suffer any adverse effects due to being slightly unbalanced.

IN THE WORKPLACE

In some areas, the utility places a limit of four meter positions on metering stacks. How can we balance a 19-position installation without using any five-position stacks?

Select one 4-position stack and five 3-position stacks. Set two 3-position stacks to AC and two 3-position stacks to BC.

The result is 13 meter sockets on A, 13 on B and 12 on C. This system is not perfectly balanced, but it is as close as physically possible..



PHASE-BALANCING IN THE FIELD

Ring vs. Ringless

Earlier in this module, we mentioned ring-type and ringless style metering stacks. But we didn't really get in depth regarding this distinction.

Ring-type construction allows the meter to be removed without also having to remove the individual meter cover. Ring types include:

- Screw ring – tightened with a slotted screwdriver, can be sealed by the utility
- Snap ring – utilize a tab and slot mechanical link
- Clamp ring – a pivoting latch secures the meter to the lip of the cover

Ringless meter sockets have a drawn ridge around the cover. This ridge captures the cover and secures it in place.

Just like other aspects of the metering equipment, the **ring specification is up to the utility company.**

Bypasses

Throughout this module, we have made mention of various types of bypasses without really defining their function.

In the past, if a meter in the field is pulled out for inspection or replacement, the building would lose power. But, with the rise of computer usage, there is an increasing demand for uninterrupted power.

In response to this demand, bypass accessories have been developed. **When a bypass unit is attached to a meter socket, the field technician can pull the meter without disrupting power to the building.**

While this means that the building receives unmetered power during this time, the cost of the power for so short a time is negligible.

There are three bypass types in common use today. (Figure 13.) Manual bypasses are used on ring-type metering stacks. Horn bypasses are used on ringless style metering stacks. Lever bypasses are used on all commercial metering stacks.

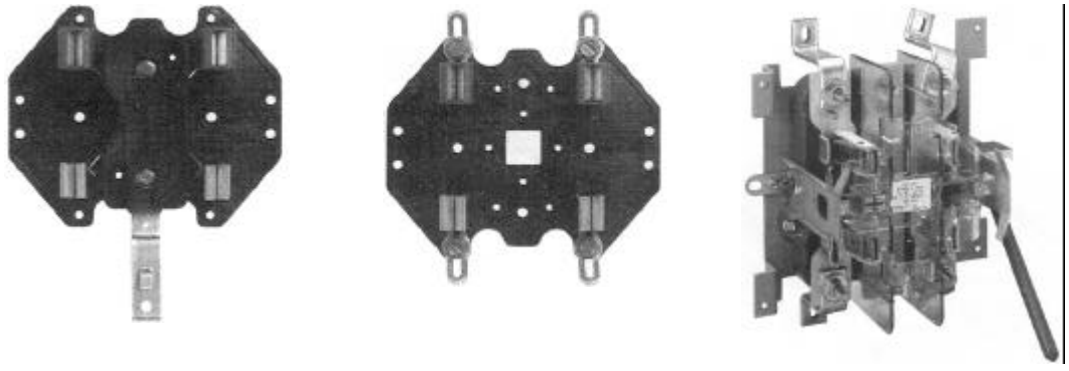


FIGURE 13. (FROM LEFT) MANUAL, HORN AND LEVER BYPASSES

Series Ratings

Metering equipment is rated by how much power it can handle. Underwriter's Laboratories (UL) certifies these equipment ratings, called *series ratings* (or "integrated equipment ratings").

Meter packs have a two-tier rating. For example, a 22/10 rating. This rating means that the meter pack has a 22 KAIC tenant main, feeding a 10 KAIC loadcenter with 10 KAIC branches.

Common meter pack ratings are 22/10, 42/10 and 100/10.

Meter centers have a three-tier rating. For example, a 100/22/10 rating. This rating means that a main fused switch rated at 100 KAIC in the main service module feeds metering stacks with 22 KAIC tenant mains. These tenant mains in turn feed 10 KAIC loadcenters with 10 KAIC branches.

Common meter center ratings include 22/22/10, 42/42/10, 100/22/10 and 100/100/10.

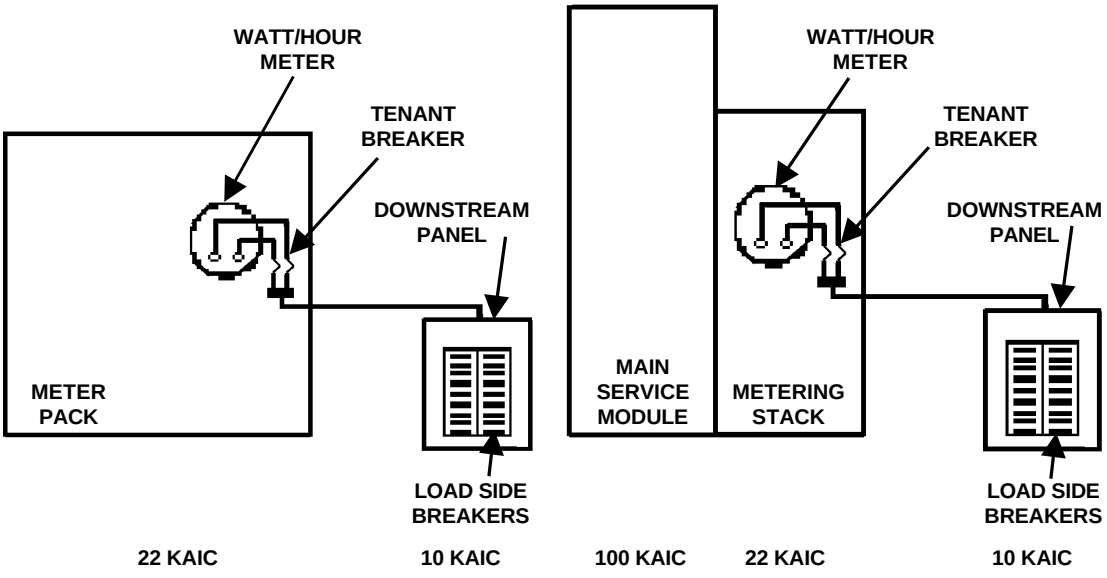


FIGURE 14. TWO-TIER (ON LEFT) AND THREE-TIER SERIES RATINGS

Note that the watt/hour meter itself is not included in the short-circuit current rating. This practice is specified in UL Code 67.

HELPING THE CUSTOMER

Now you should be ready to assist a customer in matching a product to an application. When you meet with the customer, conduct a short interview to obtain the following information:

Required Information

- Indoor or outdoor installation
- Single-phase or three-phase service
- Meter pack or metering stacks (assuming both are approved for use in the area)
- Main rating required
- Tenant mains ratings and quantity required
- Local code requirements (jaws, rings, connectors, etc.)

Example

For example, after interviewing a customer, suppose you have the following information:

- Outdoor installation of a meter center
- Three-phase, four wire service at 120/208 volts
- Main is a three-pole, 800-amp fusible switch
- Tenant mains: 16 100-amp, 2-pole and 3 200-amp, 2-pole residential mains, all providing 22 KAIC
- Utility requirements: manual bypasses, ring-type sockets with screw-type sealing rings, no more than four meter sockets allowed in a stack

With this information, you should be able to go to the product catalog and select products for the customer's application.

REVIEW 2

Answer the following questions without referring to the material just presented.

1. Together, residential and commercial meter centers are available in four different amp and phase combinations. List two of them.

   _____

   _____

2. In your own words, explain why commercial meter center enclosures have no knockouts.

   _____

   _____

   _____

   _____

3. You are laying out a meter center with 7 positions. What stacks should be chosen, and how should they be balanced?

   Stack 1 has _____ positions and the jumper should be set to _____.
   Stack 2 has _____ positions and the jumper should be set to _____.
   Stack 3 has _____ positions and the jumper should be set to _____.

4. A meter-center has a main fused switch rated at 42 KAIC in the main service module. It feeds metering stacks with 42 KAIC tenant mains. These tenant mains in turn feed 10 KAIC loadcenters with 10 KAIC branches.

   The series ratings for this meter center are _____.

5. List four of the six pieces of information you must obtain from a customer before you can select products for the application.

   _____

   _____

   _____

   _____

GLOSSARY

All-In-One	See “Meter Pack.”
Ampere Interrupt Capacity (AIC)	Also “Interrupting Rating.” A rating of the amount of current that a protective device, such as a fuse or circuit breaker, can safely interrupt.
Bolt-On	A type of breaker which is bolted into place. More secure but less easily interchangeable than a plug-in breaker. More desirable than a plug-in breaker in industrial applications.
Branch Circuit	A circuit that supplies power to the electrical loads in a building and is terminated at a distribution device (loadcenter, panelboard, etc.)
Bus Bars	A component of a distribution device (loadcenter, panelboard, etc.) that serves as an extension of the main service conductors. Simplifies the connection of branch circuit breakers to the main service conductors.
Circuit Breaker	An electrical safety device. When the current passing through it exceeds a certain amperage, the breaker trips, breaking the circuit.
Distribution Section	Section of a meter-breaker or multiple metering device where power is divided to tenant feed branch circuits.
Fusible Switch	A switch with an integrated fuse. An electrical safety device. When the current passing through it exceeds a certain amperage, the fuse blows, breaking the circuit.
Horn Bypass	An accessory used on ringless style metering stacks to provide uninterrupted power in case the meter must be removed.
Jaws	Mechanical devices used for holding an installed meter securely in place.
Kilowatt/Hour	A unit of measurement for electrical power usage. One kilowatt/hour is the use of one thousand watts of electricity in one hour.
Knockouts	Circular perforations in the top and bottom panels of a panelboard that can be removed to provide entrances and exits for feeder wires enclosed in conduit.
Lever Bypass	An accessory used on commercial metering stacks to provide uninterrupted power in case the meter must be removed.
Loadcenter	A device that delivers electricity from a supply source to loads in light commercial or residential applications.

Main Breaker	Also “Main Circuit Breaker.” A reusable overcurrent protection device designed to protect an entire panelboard or switchboard. Power from the mains is fed through a main breaker to the bus bars.
Main Service Conductors	Also “Mains.” The conductors that bring electricity into a building from the power source.
Main Service Module	Component of a meter center. Provides a utility service termination point. Also contains a means of disconnection the tenant mains.
Main Terminal Box	A disconnect device available on 400-1200 amp main service modules.
Manual Bypass	An accessory used on ring-type style metering stacks to provide uninterrupted power in case the meter must be removed.
Measuring Device	Component of a meter. A numerical readout allows the utility to measure the amount of power used.
Meter	Shortened form of the term “watt/hour meter.”
Meter-Breaker	A metering device with is a single meter socket and a loadcenter, combined into one rainproof enclosure for convenience.
Meter Center	An advanced, modular multiple metering unit commonly used residential and commercial applications as service entrance equipment. Performs the same functions as a meter pack, but also has a means of disconnecting the tenant mains.
Meter Pack	A stand-alone multiple metering unit commonly used residential applications as service entrance equipment. Unlike a meter center, it has no means of disconnecting the tenant mains.
Meter Socket	Mounting point for a watt/hour meter.
Metering Stack	Component of a meter center. Device consisting of one to six meter socket positions, vertically mounted in a single enclosure.
Multiple Metering System	A simplified metering system for use on multi-tenant buildings. Less complicated than using multiple single socket meters.

NEMA	Abbreviation for National Electrical Manufacturers Association. An organization of manufacturers of electrical products.
Phase Balancing	The act of adjusting the phase jumpers of some metering stacks in a three-phase meter center to spread the load evenly across the three power phases.
Plug-In	A type of breaker which is plugged into place. Less secure but more easily interchangeable than a bolt-on breaker.
Pole	Refers to the number of wires that the switch disconnects at one time.
Ring-Type	A type of meter construction in which a ring secures the meter in place to prevent unauthorized entry.
Ringless	A type of meter construction in which the socket has a drawn ridge around the cover. This ridge captures the cover and secures it in place.
Series Ratings	A statement of the AIC ratings of meter center components.
Service Entrance	The point at which electrical power enters a building.
Six Handle Rule	An NEC ruling which states that you must be able to throw no more than six handles into the off position to disconnect electrical service.
Tenant Main	The line on which power enters a tenant unit, upstream of the tenant unit's distribution device (loadcenter, panelboard, etc.), downstream from the multiple metering equipment.
Tenant Main Disconnect	A device used to disconnect power to a tenant main, which is the line on which power enters a tenant unit, upstream of the tenant unit's distribution device (loadcenter, panelboard, etc.), downstream from the multiple metering equipment.
Voltmeter	A device used to find the potential voltage between two points.
Watt/Hour	Standard unit of measurement for electrical power usage. One watt/hour is the use of one watt of electricity in one hour.
Watt/Hour Meter	A device used for measuring electrical power usage.

REVIEW 1 ANSWERS

1. Watt/hour; one watt; one hour
2. Meter socket; loadcenter
3. Any four of the following: Apartments, Condominiums, Strip malls, Townhomes, Small office buildings, Light industrial parks
4. Any three of the following: Fusible switch, Bolted pressure switch, Molded case circuit breaker, Main terminal box
5. Answer should basically state: “This is because of an NEC ruling called ‘six subdivisions of the main.’ This ruling states that you must be able to throw no more than six handles into the off position to disconnect electrical service. So, a metering stack can contain up to six meter sockets without the need for an upstream main disconnect. To comply with this ruling as economically as possible, metering stacks are only manufactured with a maximum of six meter sockets.”

REVIEW 2 ANSWERS

1. Any two of the following: 125-amp, single-phase; 200-amp, single-phase; 200-amp, three-phase; 400-amp, three-phase
2. Answer should basically state: “Concentric knockouts for a commercial meter center enclosure would have to accommodate too many conduit sizes to be practical. The installer can simply cut hole in the needed sizes and locations during the installation.”
3. There are a few permutations of the correct solution. Here is one:
   Stack one: 3 positions, AB
   Stack two: 3 positions, AC
   Stack three: 2 positions, BC
4. 42/42/10
5. Any four of the following: Indoor or outdoor installation, Single-phase or three-phase service, Meter pack or metering stacks, Main rating required, Tenant mains ratings and quantity required, Local code requirements

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Publication No. TR.32.01.T.E
February 1999
Printed in U.S.A. (GSP)