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Revision #: N/A

Clarification #7

The following modifications and clarifications are to be accounted for when tendering on this potential contract. As well, when entering into the Form of Agreement to do the work, they shall become a part thereof.

Instruction/Clarifications:

1. Refer to TBIL Tender SK-5, SK-6, SK-7, and SK-8 for identification and clarification of exposed concrete walls.

2. Refer to Energy Distribution PDF (p95-p153; 59 pages in total).

3. The breakdown of workstations per floor is as follows:

   -1st Floor:
   23 Workstations (including 1 Reception Station)

   -2nd Floor:
   22 Workstations

   -3rd Floor:
   39 Workstations

   -4th Floor:
   60 Workstations

There will also be a need for some of the meeting rooms to be core drilled for power to come up to the power modules in the centre of the tables, however it has not been determined what furniture will be in the meeting rooms and or what meeting rooms will require power in the tables.

Revised Electrical pricing is required no later than Thursday September 15th, 2016 at 10am.

Receipt of this addendum shall be acknowledged on your tender submission. Failure to do so may result in the rejection of your tender submission.

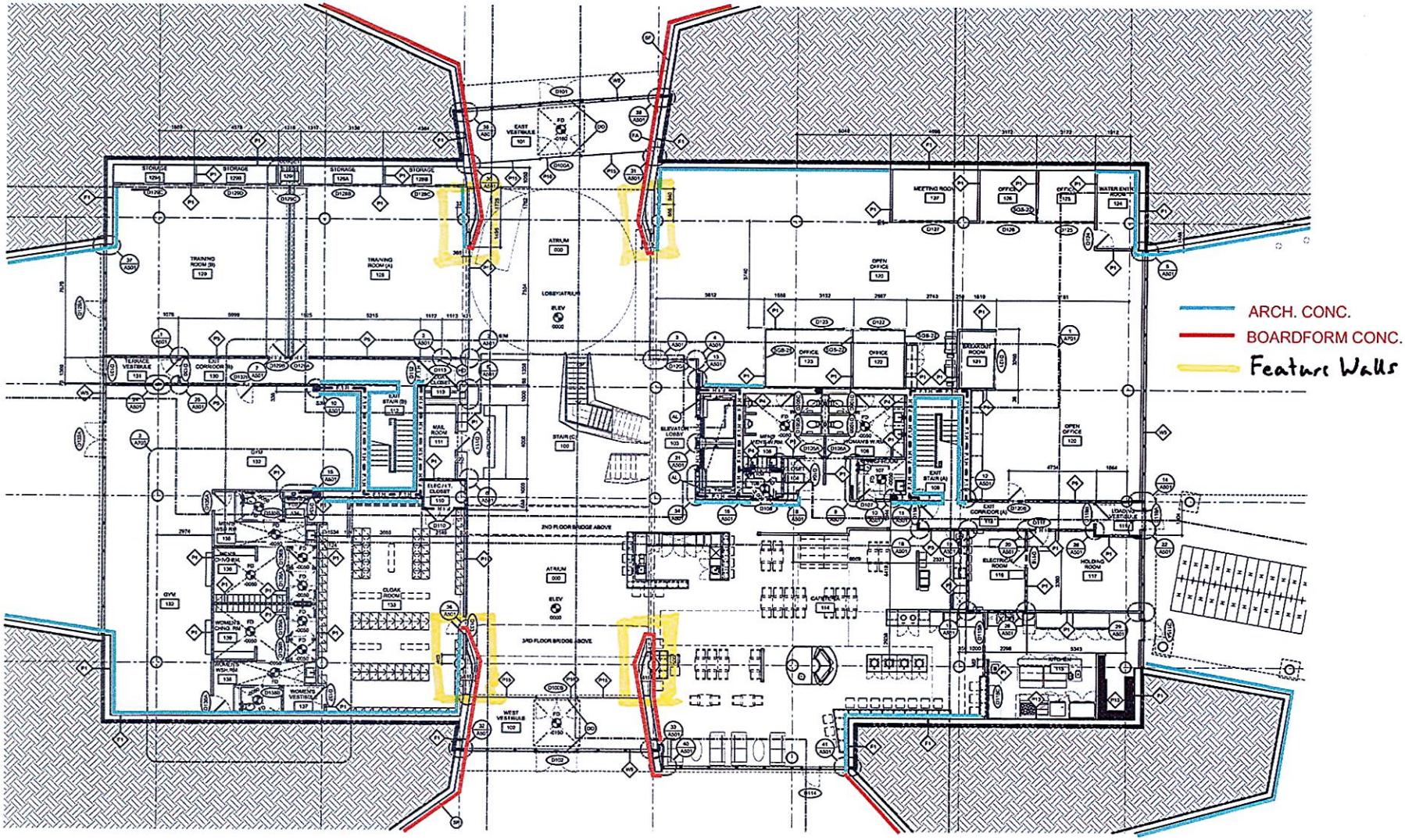
For questions or further information, please contact the office by e-mail at, info@tal-co.com.

End of Clarification #7

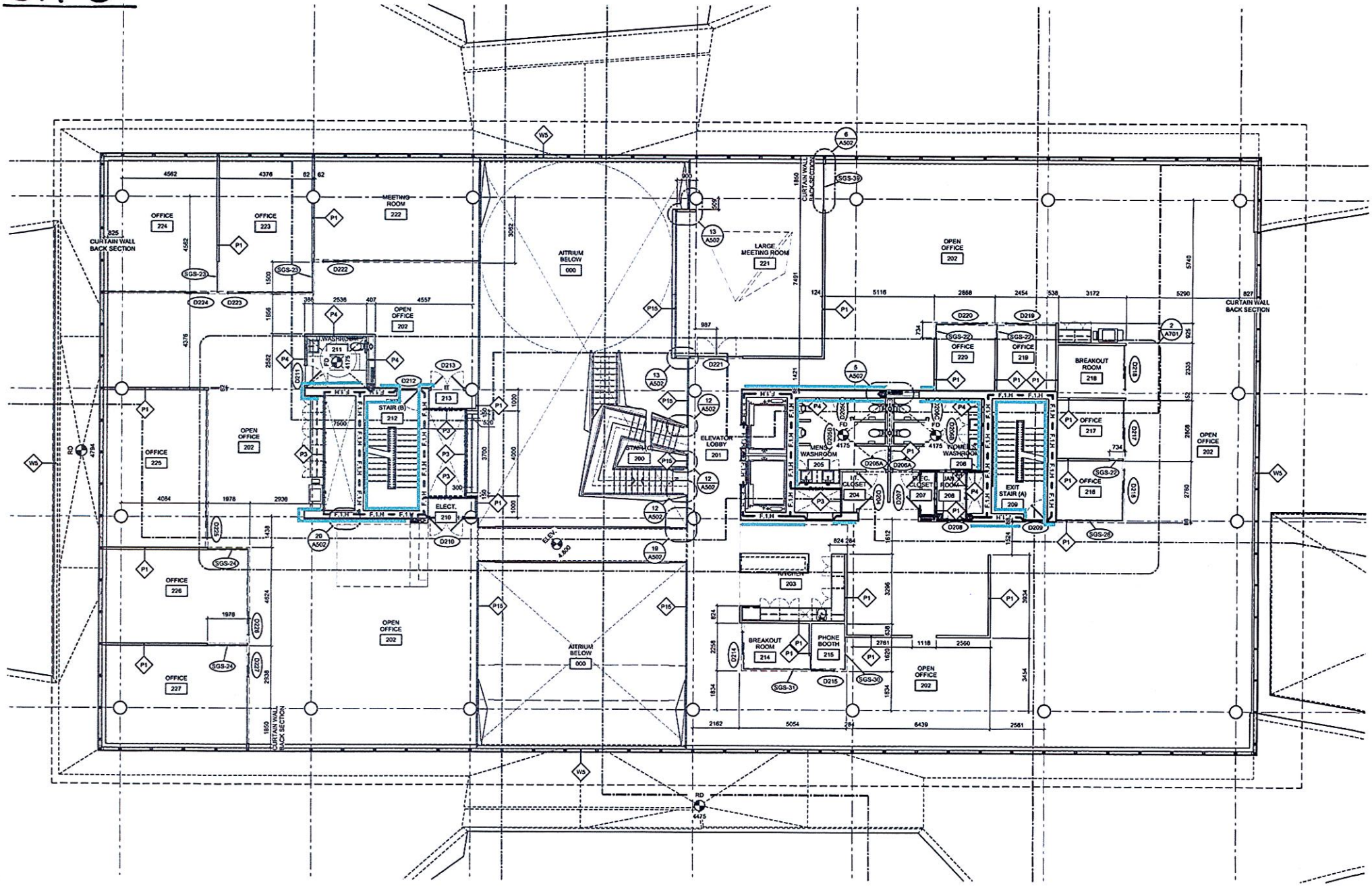
TBIL

TENDER

SK-5



TBIL
TENDER
SK-6



TBIL
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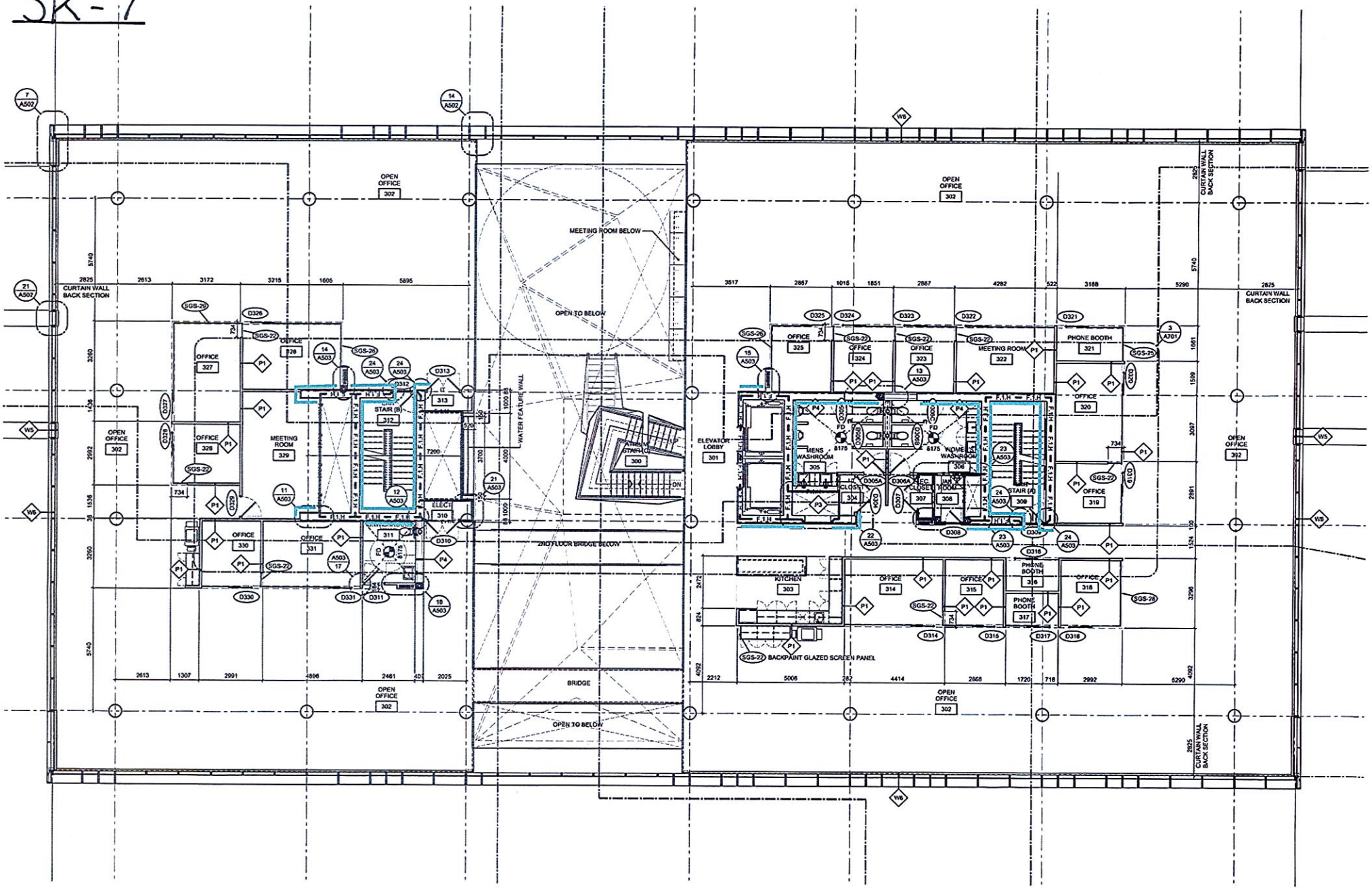
SK-7



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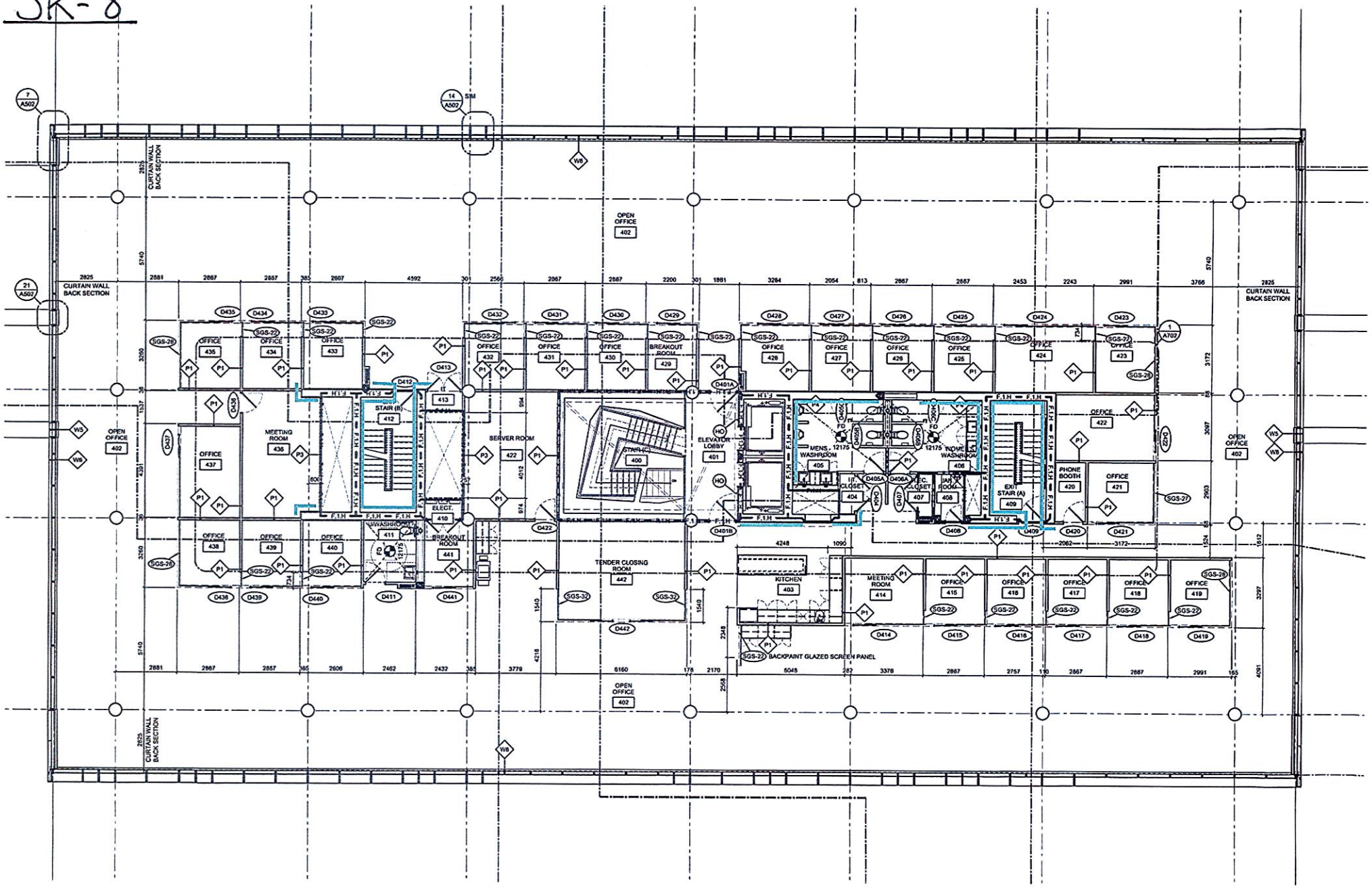
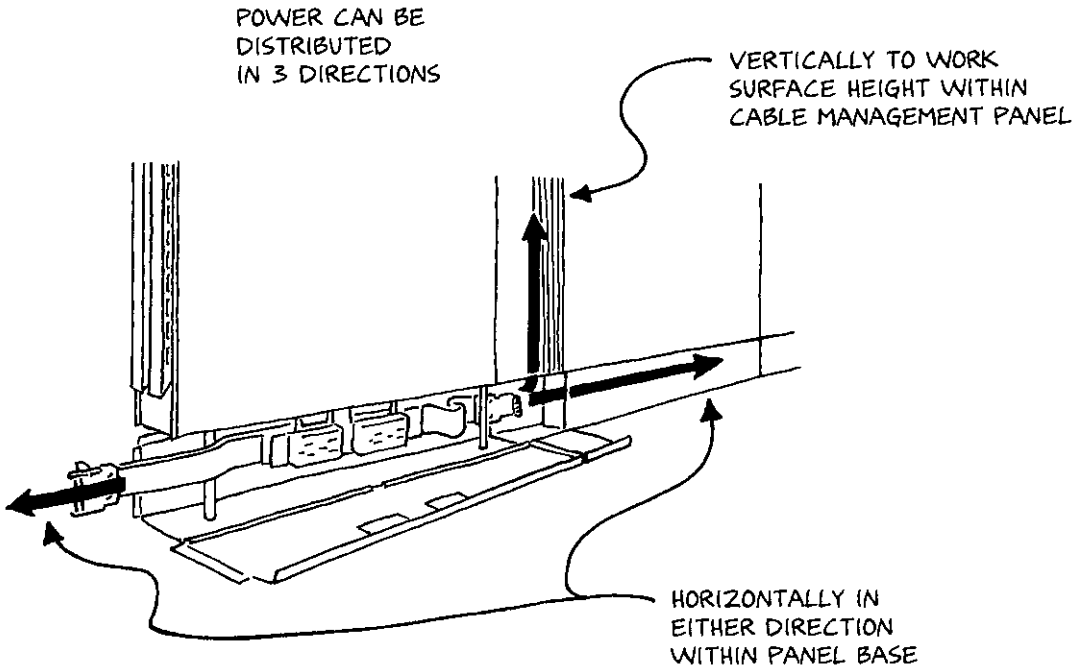
SK-8



Energy Distribution



Today's electronic office environments demand high-performance electrical distribution solutions. The power system for Action Office Series 2 panels responds easily to these needs. It is a four-circuit, eight-wire system that is extremely flexible—flexible enough to be used with nearly any common wiring system found in office buildings today, even those buildings without an eight-wire building configuration. It is the eight-wire building wiring configuration, however, that allows the Series 2 power system to deliver the optimum level of performance to each workstation.

System Overview

Action Office Series 2 panels offer these energy features:

- Eight-wire electrical distribution with up to four circuits, including one dedicated circuit and multiple isolated ground circuits, in the base of the panel
- A vertical cable management panel that allows energy and voice/data cables to be brought to work surface height and voice/data cables to other heights along the panel frame, providing easy access to them at various heights within a workstation
- A cable distribution channel, with hinged side covers for quick access to wires and cables at the panel base; the channel conceals cables and Local Area Network (LAN) components
- An optional metal barrier to separate sensitive voice/data cables from electrical wires
- An optional panel-top raceway for equal-height panels, to physically separate cables and power between the panel top and the panel base
- The ability to provide power entry directly into the panel base from the floor or wall or through ceiling entry poles
- The ability to convert nonpowered panels to powered panels in the field
- Underwriters' Laboratories (UL) listing, Canadian Standards Association (CSA) certification, and conformance with the National Electrical Code (NEC) and most local codes

Basic Electrical Terms

A basic understanding of electrical terms is critical to the planning process. The following terms are used throughout this planning information; for additional information, consult the National Electrical Code (NEC).

Amperage—unit of electrical current flowing through a circuit.

Voltage—measurement of electrical pressure required to move electrical current through a circuit. Most office equipment requires 120 volts; however, many large pieces of equipment, e.g., copiers, require 220 volts.

Circuit—complete path or loop of electrical current that takes power from its source to an electrical device or a piece of equipment, then returns what is left to its original source. A simple circuit requires these three wires:

- Hot wire (delivers electrical current to the device)
- Neutral wire (returns electrical current to the power source)
- Ground wire (diverts short-circuit electricity to the earth)

Ground wire—wire that protects users from shock or electrocution by diverting short-circuit electricity into the earth. For safety reasons, every circuit utilizes a ground wire that must be in contact with all exposed-metal parts that could be energized.

Branch circuit—circuit that provides power from the fuse box or breaker to electrical outlets.

Designated circuit—circuit that has been reserved for a particular usage, e.g., lighting; does not require special wiring.

Isolated ground circuit—circuit with an isolated ground wire that is totally separated from the general or system ground.

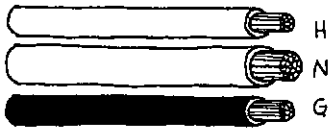
Dedicated circuit—circuit that provides unshared power for computers or other sensitive electronic equipment; requires separate hot, neutral, and ground wiring. (For additional information, see "Key Regulations.")

Circuit Capacity and Configurations

Typical Circuit Configurations

The following diagrams depict several basic circuit configurations.

Basic Electrical Circuit
H – Hot wire
N – Neutral
G – Ground



BASIC
ELECTRICAL
CIRCUIT

Four-Wire, Two-Circuit System
This wiring configuration is commonly used with single-phase power and is usually found in homes and older commercial buildings. The neutral wire is shared between two hot wires.

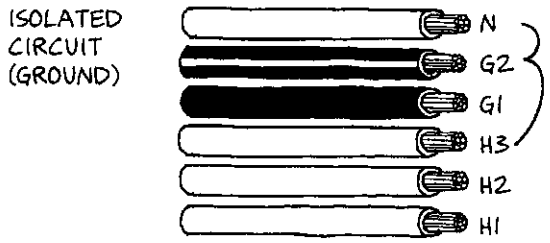
H1 – Hot wire—for *a* circuit
H2 – Hot wire—for *b* circuit
N – Neutral (shared)
G – Ground (shared)

Five-Wire, Three-Circuit System
This configuration requires three-phase power to energize all three circuits and has become the standard electrical delivery to most commercial buildings, due to its efficiency over single-phase power. In this configuration, the neutral wire is shared among three hot wires. The configuration offers three designated circuits.

H1 – Hot wire—for *a* circuit
H2 – Hot wire—for *b* circuit
H3 – Hot wire—for *c* circuit
N – Neutral (shared)
G – Ground (shared)

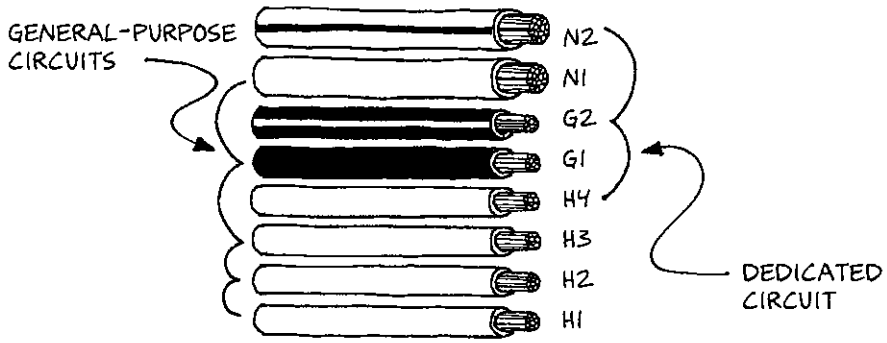
Six-Wire, Three-Circuit System with Isolated Ground
In this three-circuit configuration, the third circuit has an isolated (physically separated) ground wire.

N – Neutral (shared)
G2 – Ground (isolated)
G1 – Ground (shared)
H3 – Hot wire—for *c* circuit
H2 – Hot wire—for *b* circuit
H1 – Hot wire—for *a* circuit



Eight-Wire, Four-Circuit System with Dedicated Circuit
In this Herman Miller four-circuit electrical system, the fourth circuit has a separate neutral and isolated ground wire. This creates a dedicated circuit in that each of the three wires (*N2, G2,* and *H4*) is separate from any other circuit.

N2 – Neutral (dedicated)
N1 – Neutral (shared)
G2 – Ground (isolated)
G1 – Ground (shared)
H4 – Hot wire (dedicated)—for *d* circuit
H3 – Hot wire (general)—for *c* circuit
H2 – Hot wire (general)—for *b* circuit
H1 – Hot wire (general)—for *a* circuit



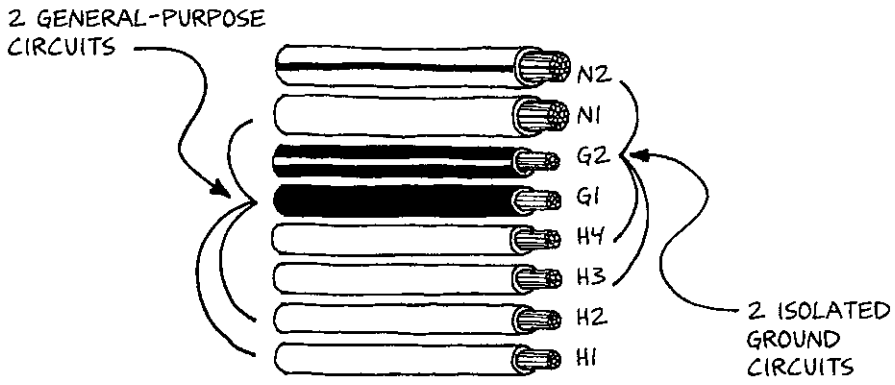
DEDICATED CIRCUIT (4-CIRCUIT)
FOR ILLUSTRATION PURPOSES ONLY.
FOR ACTUAL WIRING PATTERN,
SEE WIRING DIAGRAMS.

Multiple Isolated Ground Circuit Configurations

The following configurations allow users to obtain maximum isolated ground circuit capacity from this Herman Miller four-circuit system.

Two Isolated Ground Circuits

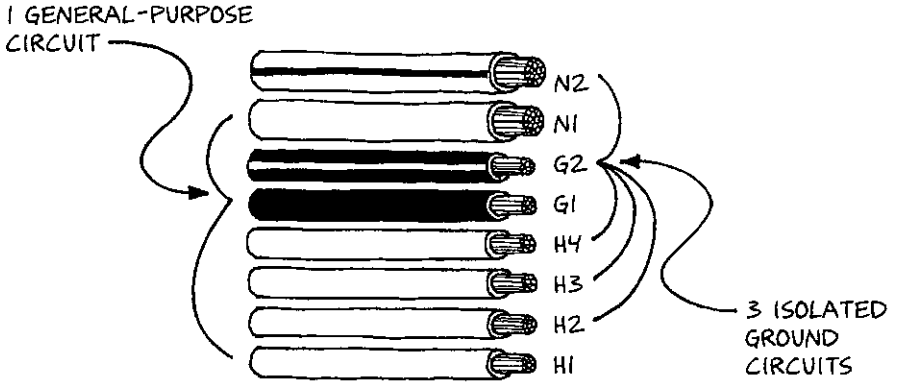
N2 – Neutral (shared)
N1 – Neutral (shared)
G2 – Ground (isolated; shared with *C1*) and *d* circuit
G1 – Ground (shared)
H4 – Hot wire (computer)—for *d* circuit
H3 – Hot wire (computer)—for *c* circuit (using *C1* receptacle)
H2 – Hot wire (computer)—for *b* circuit (using *B1* receptacle)
H1 – Hot wire (general)—for *a* circuit



ISOLATED GROUND CIRCUIT (4-CIRCUIT WITH 2 ISOLATED GROUND CIRCUITS)
FOR ILLUSTRATION PURPOSES ONLY. FOR ACTUAL WIRING PATTERN, SEE WIRING DIAGRAMS.

Three Isolated Ground Circuits

N2 – Neutral (shared)
N1 – Neutral (shared)
G2 – Ground (isolated; shared with *B1*, *C1*) and *d* circuit
G1 – Ground (shared)
H4 – Hot wire (computer)—for *d* circuit
H3 – Hot wire (computer)—for *c* circuit (using *C1* receptacle)
H2 – Hot wire (computer)—for *b* circuit (using *B1* receptacle)
H1 – Hot wire (general)—for *a* circuit



ISOLATED GROUND CIRCUIT (4-CIRCUIT WITH 3 ISOLATED GROUND CIRCUITS)
FOR ILLUSTRATION PURPOSES ONLY. FOR ACTUAL WIRING PATTERN, SEE WIRING DIAGRAMS.

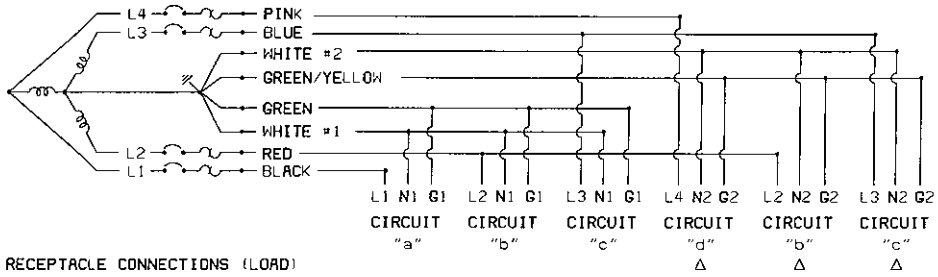
Before planning, it is important to understand the types of circuit configurations commonly found in the office environment—as well as those configurations available with this product line. The illustrations show the most common connections.

With this Herman Miller system, each of the four circuits is rated to distribute 20 amps of current at 120 volts. However, due to code requirements, in most cases actual amperage loads will be less. (See "Key Regulations.")

Circuit capacity is also stated in terms of duplex receptacles, with a maximum of 13 receptacles allowed per circuit. For planning purposes, circuit capacity should be based on actual amperage loads, not on the number of duplex receptacles.

CONNECTION TO A GROUNDED THREE-PHASE SYSTEM

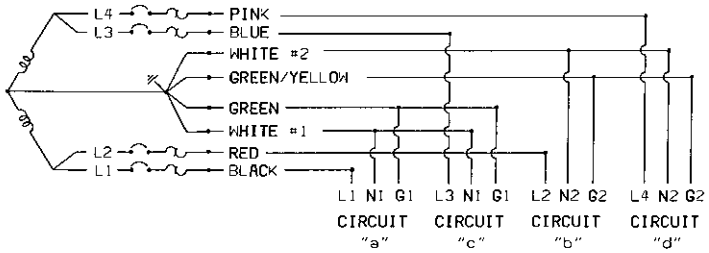
RATING: 120/208V, 3-PH WYE, 60-HZ
20-AMP MULTIWIRE BRANCH CIRCUIT



RECEPTACLE CONNECTIONS (LOAD)

CONNECTION TO A GROUNDED SINGLE-PHASE SYSTEM

RATING: 120/240V, 1-PH, 60-HZ
20-AMP MULTIWIRE BRANCH CIRCUIT



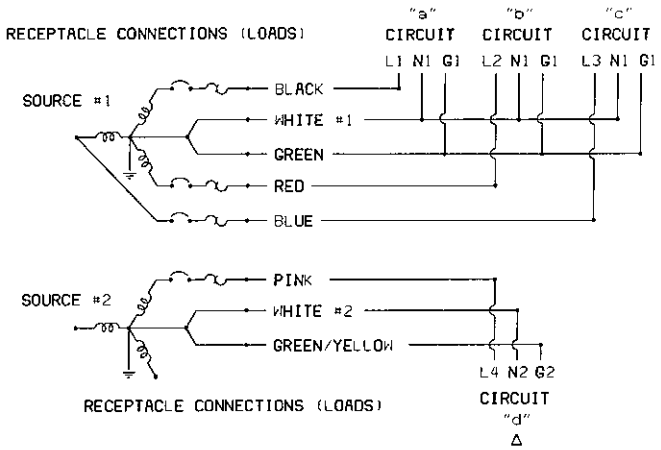
RECEPTACLE CONNECTIONS (LOAD)

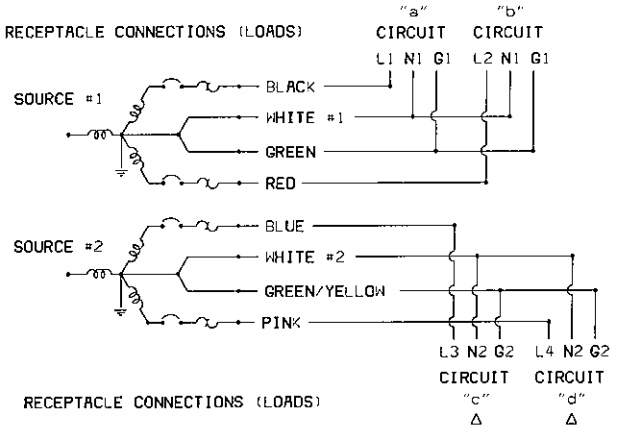
NOTES:

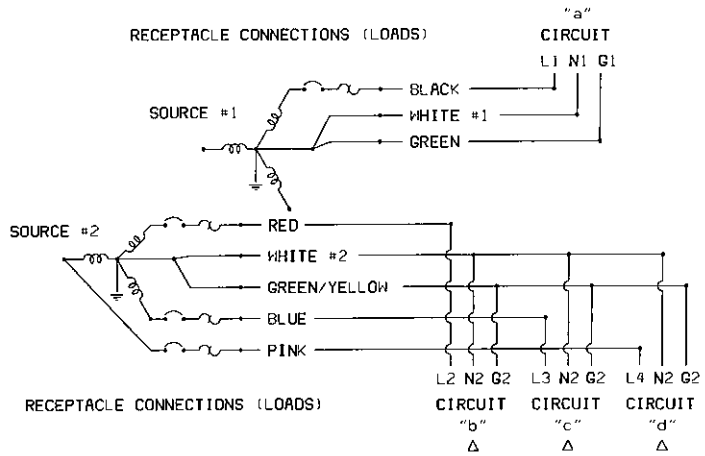
1. N1 AND N2 ARE 10-GA. CONDUCTORS.
2. GREEN/YELLOW CONDUCTOR CAN BE USED AS AN ISOLATED GROUND.

CONNECTIONS TO MULTIPLE GROUNDED
THREE-PHASE POWER SOURCES

RATING: 120/208-V, 3-PH WYE, 60-HZ
20-AMP MULTIWIRE BRANCH CIRCUIT







Key Regulations

The National Electrical Codes (NEC) and local codes affect electrical system planning. A few of the most critical ones follow; however, this listing is by no means exhaustive. All relevant codes (including local codes) should be reviewed thoroughly before planning the installation, and all work should be completed by a qualified contractor in accordance with those codes.

The building's electrical capacity and wiring configuration (single-phase, three-phase, or special branch circuits) should also be checked in order to ensure the most effective application of this four-circuit, eight-wire electrical system.

"Derating" for Continuous Loading

For safety reasons, the NEC requires that a circuit be "derated" by 20 percent when used under a continuous load. In other words, the 20-amp rating for this circuit makes this, in effect, a 16-amp-rated circuit under continuous-load conditions.

Continuous load is defined as a load under which maximum current is expected to continue for three hours or more. Lighting and personal computers are usually considered continuous-load equipment. Typewriters, calculators, and other desktop equipment may or may not be; check the requirements of the individual workstation carefully before assigning an amp rating.

Maximum Number of Receptacles Allowed

According to the NEC, the maximum number of receptacles allowed per circuit is 13. However, when the circuit is derated by 20 percent for continuous loading, the number of receptacles per circuit is effectively reduced to 10. To ensure reserve capacity for future needs, the number should be further reduced.

Receptacle Ratings

Receptacles are rated for a 15- or 20-amp load and can supply a maximum single-device load of 12 or 16 amps. This four-circuit, eight-wire system is designed to supply multiple receptacle loads per circuit as specified by the NEC.

Amperage Limitations on Single Devices

If any single device draws more than 80 percent of the available amperage of a circuit, it must be the only device connected to that circuit. For example, if a copy machine draws 16 amps, nothing else can be connected to the circuit.

Use of Dedicated Circuits

ANSI/BIFMA (American National Standards Institute/Business and Institutional Furniture Manufacturers' Association) guidelines define a dedicated circuit as one that consists of three conductors (hot, neutral, and ground) between the circuit breaker and the receptacle dedicated for use with that equipment. These conductors are not shared with other circuits and must also be fed from a dedicated building circuit.

Voltage Limitations

This four-circuit, eight-wire system accommodates only 120-volt devices. This means that, for instance, a large office copier requiring 220 volts will have to be connected to an alternative electrical distribution system within the building.

Multiple Power Entries—WARNING

All power sources must be disconnected prior to servicing. No single circuit may be powered by more than one source.

When more than one power entry is required to power a cluster of workstations, harnesses from the first infeed must *never* be electrically connected to harnesses from another infeed.

Use of Qualified Electrical Contractors

All electrical connections to the building power source must be made by a qualified electrical contractor in accordance with all national and local codes.

Electrical System Incompatibility

The Series 2 energy system is not compatible with any other system, including the Action Office Series 1 three-circuit electrical system, the Series 3 electrical system, the Ethospace electrical system, or any similar energy products used on other furniture lines. The energy system for Action Office Series 2 panels *is* compatible mechanically and electrically with Action Office Series 1 panels and connectors that have the optional four-circuit conversion base kits.

Forward and Side Reach for Receptacles

In addition to local and national electrical codes, the Federal Register; Volume 56, No. 144; Friday, July 26, 1991, outlines rules and regulations for wheelchair-bound persons that apply to forward and side reach that can affect placement of receptacles.

If the clear floor space allows only *forward approach* to an object, the maximum *high* forward reach allowed is 48". The minimum *low* forward reach is 15". If the high forward reach is over an obstruction, like a work surface, the maximum *high* forward reach is reduced to 44" over an obstruction of a maximum 25" wide.

If the clear floor space allows *parallel approach* to an object, the maximum *high* side reach allowed is 54", and the *low* side reach is no less than 9" above the floor. If the side reach is over an obstruction, again like a work surface, the maximum *high* side reach is reduced to 46" over an obstruction of a maximum 34" high and 24" wide.

Planning Process Overview

Effective planning for this Herman Miller electrical distribution system requires four basic steps. Following these steps in sequence will ensure that the system is designed to accommodate both present and future power needs.

Step One—Electrical Needs. This step involves listing all office equipment required in each workstation, along with appropriate amperages.

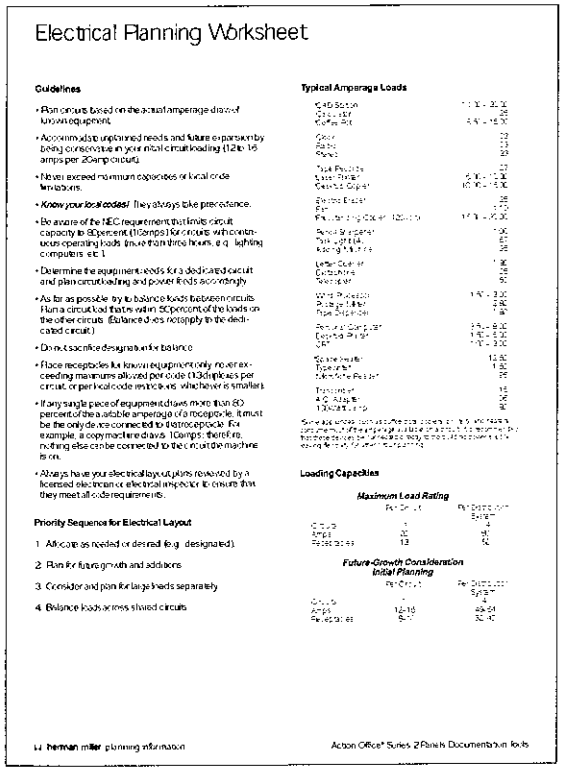
Step Two—Electrical Access. This step determines the type of circuits (designated, dedicated, and general) and quantity of receptacles needed to power each workstation and the total for all workstations. During this step, loads are balanced; based on special equipment needs, certain circuits are designated or dedicated.

Step Three—Electrical Distribution. This step calculates the total number of circuits required to meet each cluster's electrical requirements.

Step Four—Electrical Supply. This step determines the number of power entries required to supply power from the building's electrical source to the workstation cluster.

Each of these steps is discussed in detail in the information that follows.

Note: Individual Electrical Planning Worksheets are available in the *Action Office® Series 2 Panels Documentation Tools* package (0.A7000-3).



Electrical Planning Worksheet

Guidelines

- Plan circuits based on the actual amperage draw of known equipment.
- Accommodate unplanned needs and future expansion by being conservative in your initial circuit loading (12 to 16 amps per 20-amp circuit).
- Never exceed maximum capacities of local code limitations.
- *Know your local codes!* They always take precedence.
- Be aware of the NEC requirement that limits circuit capacity to 80 percent (16 amps) for circuits with continuous operating loads (more than three hours, e.g. lighting computers, etc.).
- Determine the equipment needs for a dedicated circuit and plan circuit loading and power feeds accordingly.
- As far as possible, try to balance loads between circuits. If on a circuit that is within 80 percent of the loads on the other circuits. (Balance does not apply to the dedicated circuit.)
- Do not sacrifice design to achieve balance.
- Place receptacles for known equipment only no more than exceeding maximums allowed per code (13 duplexes per circuit, or per local code restrictions, whichever is smaller).
- If any single piece of equipment draws more than 80 percent of the available amperage of a receptacle, it must be the only device connected to that receptacle. For example, a copy machine draws 10 amps; therefore, nothing else can be connected to the circuit the machine is on.
- Always have your electrical layout plans reviewed by a licensed electrician or electrical inspector to ensure that they meet all code requirements.

Priority Sequence for Electrical Layout

1. Allocate as needed or desired (e.g. designated).
2. Plan for future growth and additions.
3. Consider and plan for large loads separately.
4. Balance loads across shared circuits.

Typical Amperage Loads

Loading Capacities

Maximum Load Rating

Future-Growth Consideration Initial Planning

herman miller planning information

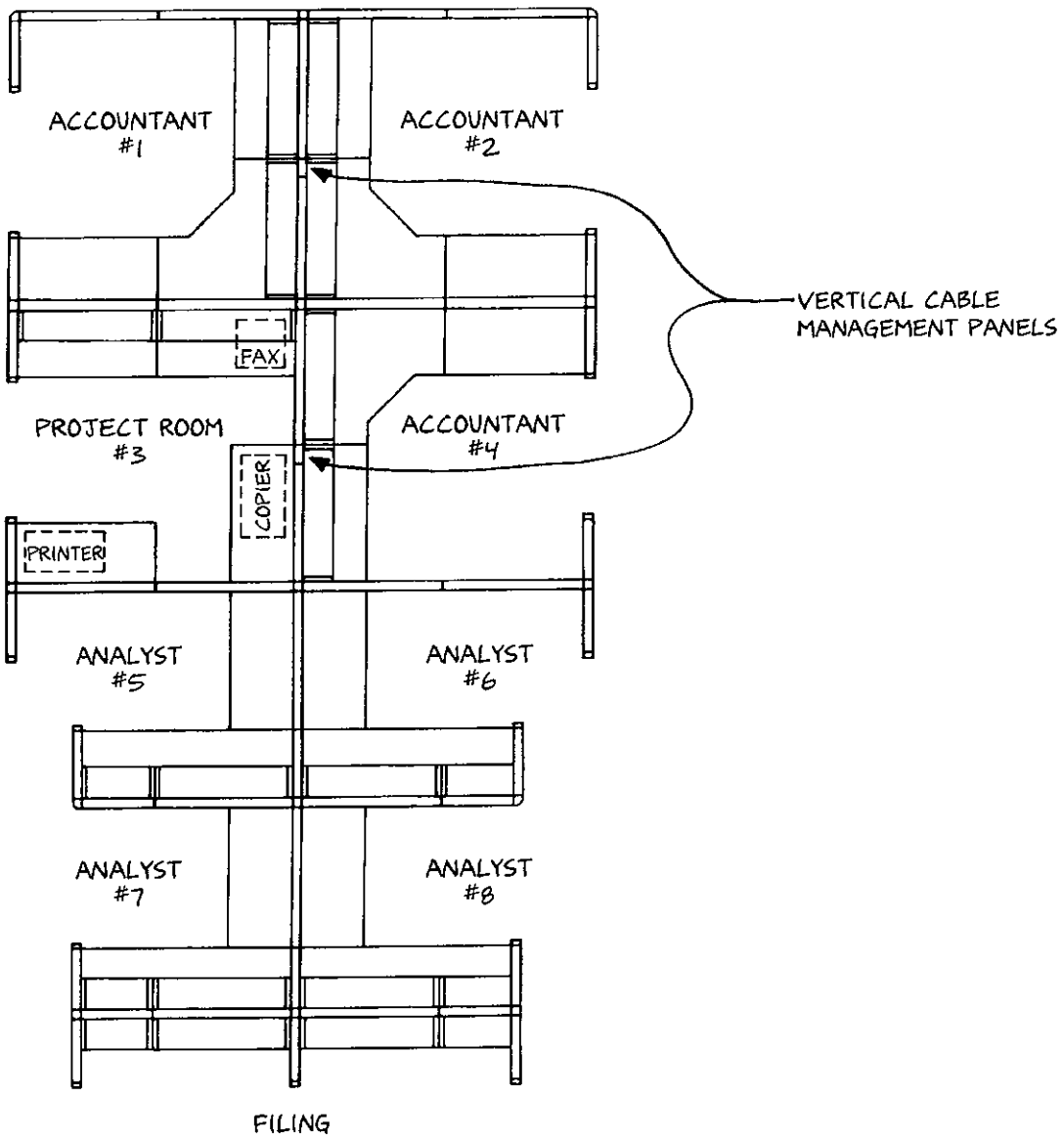
Action Office® Series 2 Panels Documentation Tools

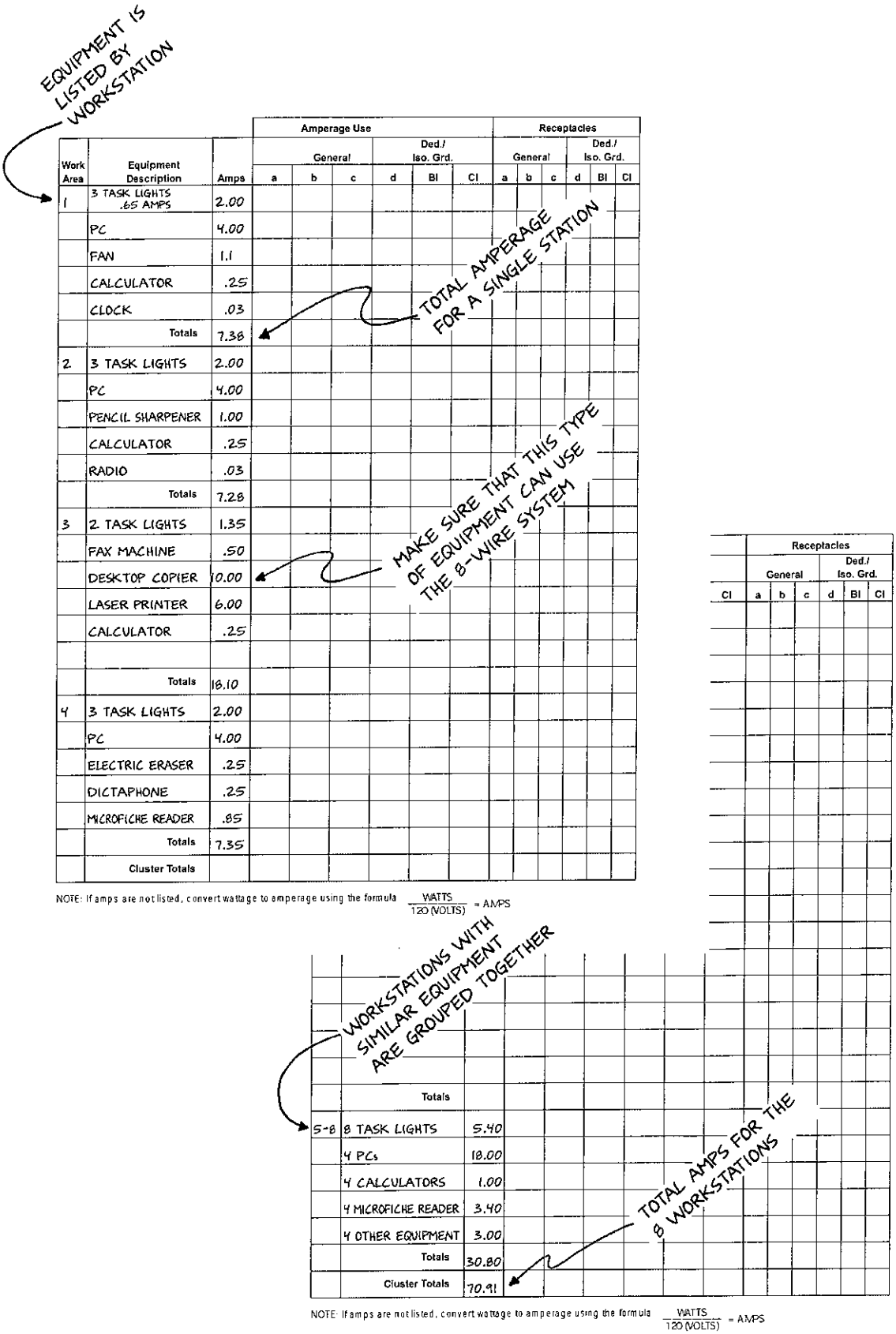
Step One—Electrical Needs

The primary objective of this step is to determine the equipment and amperage requirements of each individual workstation and, then, of the total cluster.

To arrive at this listing, use the "Electrical Planning Worksheet" from the *Action Office Series 2 Panels Documentation Tools* package. (See the sample worksheet.) As an aid in estimating the required amperage, the worksheet also includes a list of typical office machines and their amperage draw. Exact information on equipment amperage and voltage requirements can be found on the equipment itself (on the nameplate) or on the equipment specifications sheets. This information overrules any of the general guidelines on the chart.

Notice that when similar workstations (ones having the same electrical requirements) are clustered, their amperage requirements can be grouped together to save time (stations 5 – 8, for example).





			Amperage Use						Receptacles					
			General			Ded./ Iso. Grd.			General			Ded./ Iso. Grd.		
Work Area	Equipment Description	Amps	a	b	c	d	Bl	Cl	a	b	c	d	Bl	Cl
1	3 TASK LIGHTS .65 AMPS	2.00												
	PC	4.00												
	FAN	1.1												
	CALCULATOR	.25												
	CLOCK	.03												
	Totals	7.38												
2	3 TASK LIGHTS	2.00												
	PC	4.00												
	PENCIL SHARPENER	1.00												
	CALCULATOR	.25												
	RADIO	.03												
	Totals	7.28												
3	2 TASK LIGHTS	1.35												
	FAX MACHINE	.50												
	DESKTOP COPIER	10.00												
	LASER PRINTER	6.00												
	CALCULATOR	.25												
	Totals	18.10												
4	3 TASK LIGHTS	2.00												
	PC	4.00												
	ELECTRIC ERASER	.25												
	DICTAPHONE	.25												
	MICROFICHE READER	.85												
	Totals	7.35												
	Cluster Totals													

NOTE: If amps are not listed, convert wattage to amperage using the formula $\frac{\text{WATTS}}{120\,(\text{VOLTS})} = \text{AMPS}$

			Receptacles					
			General			Ded./ Iso. Grd.		
Cl	a	b	c	d	Bl	Cl		

	Totals	
5-8	8 TASK LIGHTS	5.40
	4 PCs	18.00
	4 CALCULATORS	1.00
	4 MICROFICHE READER	3.40
	4 OTHER EQUIPMENT	3.00
	Totals	30.80
	Cluster Totals	70.91

NOTE: If amps are not listed, convert wattage to amperage using the formula $\frac{\text{WATTS}}{120\,(\text{VOLTS})} = \text{AMPS}$

Step Two—Electrical Access

Allocating Receptacles
The principal means of electrical access with this Herman Miller system is the receptacle. Remembering that up to 20 amps or 13 receptacles are available per circuit, use the right-hand portion of the "Electrical Planning Worksheet" to determine the number of receptacles needed to power the equipment listed.

Remember to allow for continuous loads and future growth.

Receptacle Locations
When installed in a cutout at the base of a powered panel, a receptacle permits access to power from that side of the panel. Except on the 12"- and 18"-wide panels (which have no receptacle locations) and the 6"-wide cable management panel (which offers two receptacles at work surface height), there are two duplex receptacle locations on each side of every panel, regardless of the panel width. Those receptacles are located 2 1/2" from the panel center.

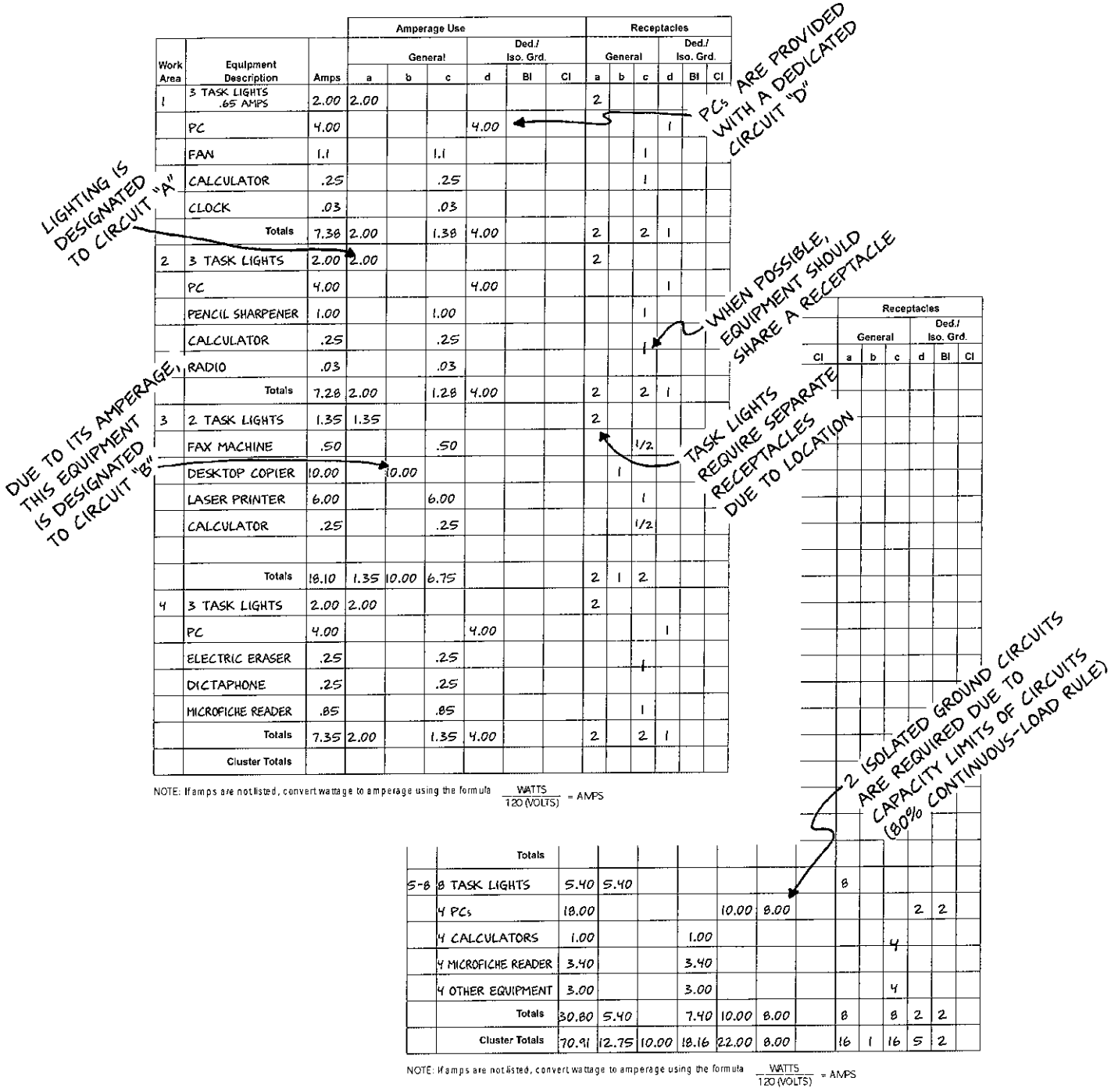
All receptacles are rated at 15 or 20 amps. While most receptacles used with this system are duplex, a surge suppression simplex receptacle is also available on certain circuits.

Assessing the Building's Circuit Capability
Before any circuit selection for an existing building is made, it is critical to know the building's circuit capability. If the building can handle only two or three circuits from each power supply point, or if the building is not wired for extra neutral or isolated ground wires, then circuit selection will be limited accordingly. If, however, it is early enough in the planning process to have input concerning the building's circuit capacity, specifying a four-circuit, eight-wire system will allow the user to take fullest advantage of the capabilities of this Herman Miller electrical system.

Remember, the *d*, *Bl*, and *Cl* receptacles access the second isolated ground and second neutral and, as a result, will not work unless the building supply has those same wires.

Determining the Need for Designated Circuits
To facilitate the maintenance of the electrical system and equipment, some planners prefer to designate circuits for particular types of equipment. (Note how the copier in Workstation #3 has been designated for the *b* circuit.) Circuit designation requires no special wiring.

The "Electrical Planning Worksheet" provides a space for designating equipment on the *a*, *b*, and *c* circuits.



Work Area	Equipment Description	Amps	Amperage Use: General a	b	c	Ded./Iso. Grd. d	Bl	Cl	Receptacles: General a	b	c	Ded./Iso. Grd. d	Bl	Cl
1	3 TASK LIGHTS .65 AMPS	2.00	2.00						2					
	PC	4.00				4.00						1		
	FAN	1.1			1.1						1			
	CALCULATOR	.25			.25						1			
	CLOCK	.03			.03									
	Totals	7.38	2.00		1.38	4.00			2		2	1		
2	3 TASK LIGHTS	2.00	2.00						2					
	PC	4.00				4.00						1		
	PENCIL SHARPENER	1.00			1.00						1			
	CALCULATOR	.25			.25						1			
	RADIO	.03			.03									
	Totals	7.28	2.00		1.28	4.00			2		2	1		
3	2 TASK LIGHTS	1.35	1.35						2					
	FAX MACHINE	.50			.50						1/2			
	DESKTOP COPIER	10.00		10.00						1				
	LASER PRINTER	6.00			6.00						1			
	CALCULATOR	.25			.25						1/2			
	Totals	18.10	1.35	10.00	6.75				2	1	2			
4	3 TASK LIGHTS	2.00	2.00						2					
	PC	4.00				4.00						1		
	ELECTRIC ERASER	.25			.25						1			
	DICTAPHONE	.25			.25									
	MICROFICHE READER	.85			.85						1			
	Totals	7.35	2.00		1.35	4.00			2		2	1		
	Cluster Totals													

NOTE: If amps are not listed, convert wattage to amperage using the formula $\frac{\text{WATTS}}{120\ (\text{VOLTS})} = \text{AMPS}$

										Receptacles: General a	b	c	Ded./Iso. Grd. d	Bl	Cl
	Totals														
5-8	8 TASK LIGHTS	5.40	5.40							8					
	4 PCs	18.00				10.00	8.00						2	2	
	4 CALCULATORS	1.00			1.00							4			
	4 MICROFICHE READER	3.40			3.40										
	4 OTHER EQUIPMENT	3.00			3.00							4			
	Totals	30.80	5.40		7.40	10.00	8.00			8		8	2	2	
	Cluster Totals	70.91	12.75	10.00	18.16	22.00	8.00			16	1	16	5	2	

NOTE: If amps are not listed, convert wattage to amperage using the formula $\frac{\text{WATTS}}{120\ (\text{VOLTS})} = \text{AMPS}$

Determining the Need for Dedicated Circuits
Certain electronic devices—usually computers—are sensitive to deviations in their power supply. Such power problems can be caused by the operation of other equipment on a circuit that "shares" neutral or ground wires with an electronic device. These problems can be cleared up by providing a dedicated circuit for use by sensitive equipment or providing isolated circuits that are shared only by other similar equipment.

To provide a dedicated circuit to a workstation—for example, to utilize the *d* circuit—both the systems furniture *and* the building itself must be wired for a dedicated circuit.

An uninterruptible power system (UPS) is a system that provides an alternate power supply should the regular power supply be interrupted or disconnected. If the building has such a system, its power should be brought to the workstation through the dedicated circuit. In fact, the dedicated circuit is most fully utilized—and offers the most protection—when it is hooked up to the UPS source.

This Herman Miller electrical system is designed to accommodate both dedicated and non-dedicated circuits. The "Electrical Planning Worksheet" provides a space for indicating whether equipment requires a dedicated circuit, isolated ground circuits, or general circuits. (See the columns under "Receptacles" on the sample worksheet.)

Determining the Need for Isolated Ground Circuits
An isolated ground runs from the receptacle back to the building electrical service entry. Because it does not come into contact with any other ground structure that could pick up additional radiated noise, it is a cleaner ground to use with sensitive computer or electronic equipment that needs a more stable, noise-free ground situation. This Herman Miller electrical system is designed to provide up to three isolated ground circuits by using the *d* circuit and by making either the *b* or *c* circuits, or both, isolated ground circuits. The choice depends on the balance in the office environment between general office equipment and lighting and other more highly sophisticated electronic equipment. In a highly computerized office environment, for example, three isolated ground circuits may be required so that users can take advantage of the maximum isolated ground capacity from the four-circuit system.

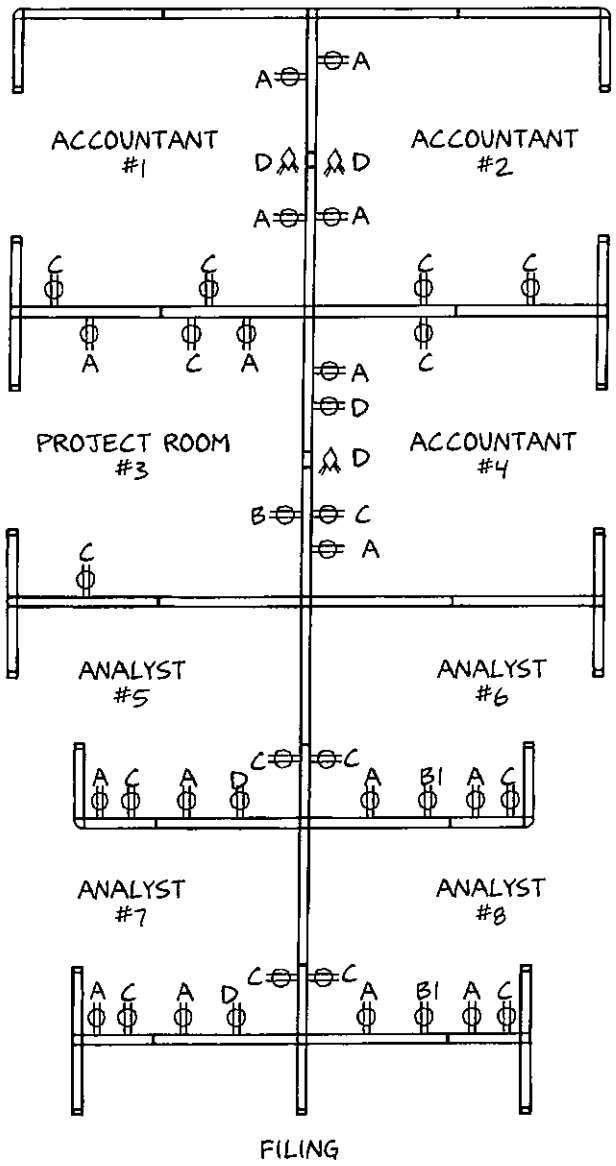
Balancing the Load
Once the total amperage requirements have been calculated and assigned to dedicated and general circuits, the next step is to balance the load among the available circuits. (When the line currents are unbalanced, the imbalance is returned through the neutral line.) Proper circuit balancing can minimize the number of power entries and allow greater flexibility for future growth.

A good rule for balance is to allocate loads so that the loading of one circuit is within 50 percent of the load on each of the other circuits. Remember, the dedicated circuit is not affected, since it does not share any wires with the general circuits.

Allocation Priority Sequence
1. Allocate as needed or desired (e.g., designate).
2. Plan for future growth and equipment additions.
3. Plan for single large loads independently.
4. Balance loads across shared circuits to minimize power entry points within the building.

Marking Receptacles on the Floor Plan

Once the electrical load and receptacles have been allocated, the floor plan should be labeled with baseline receptacle locations and circuit identification. Special notation should be made of any additional receptacles at other-than-baseline locations as well. (These should be marked on the floor plan while planning the electrical distribution.)



Legend:

⊖ A = Duplex Receptacle (with circuit identification)

⊖ D = Duplex Receptacle at different height (with circuit identification)

Step Three—Electrical Distribution

Electrical power is transmitted from the building's point of supply through the furniture system via the electrical components: the electrical harness in a powered panel or the pass-through power jumper.

Determining the Number of Circuits Needed

After listing all equipment and appropriate amperages, calculate the total number of amps required for each workstation cluster. To determine the number of circuits required, simply use the formula that follows. It is based on the maximum 20-amp rating for each circuit, but allows for future growth. To provide room for future electrical equipment, it is wise to plan initial circuit loads conservatively—well below the rated capacity. The example shown uses a 12-amp capacity per circuit, which was determined by derating the circuit to 16 amps (20 percent derating for continuous-load requirement) and then allowing four amps for future growth.

$$\frac{\textit{TOTAL AMPS}}{12} = \textit{Number of circuits needed (to allow for growth)}$$

Always remember to consider any codes that require derating of circuit capacities. (See "Key Regulations.")

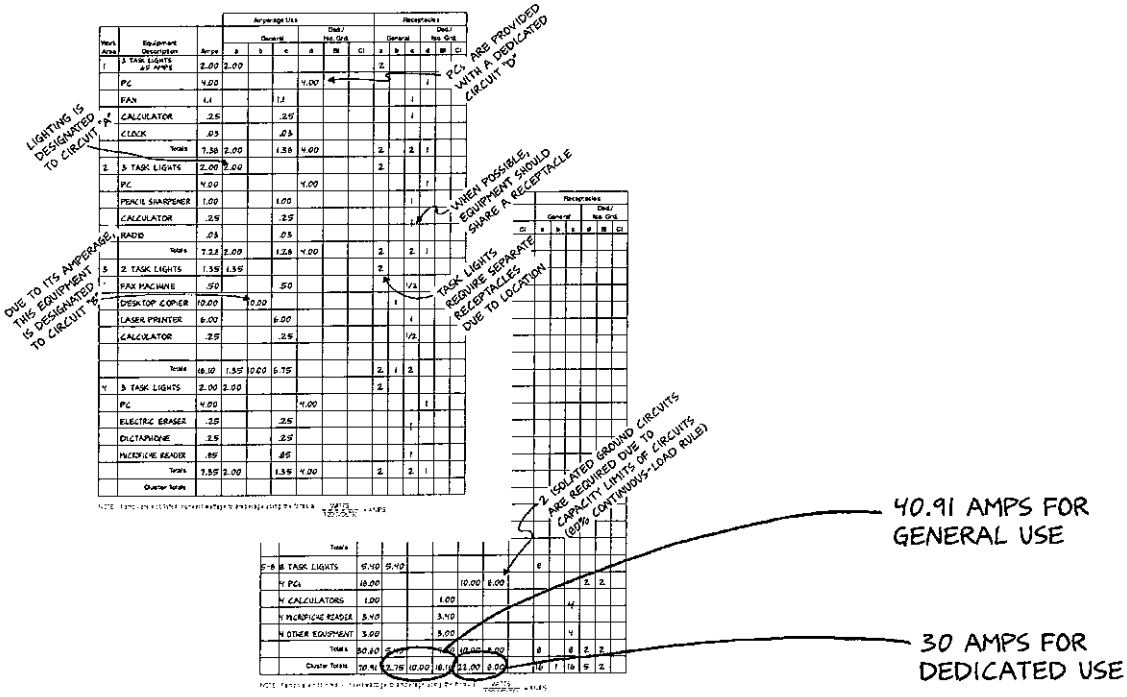
On the sample "Electrical Planning Worksheet" shown, the total amperage required to power the cluster is 40.91 amps for general use and 30 amps for dedicated use. Using the above formula, the number of circuits required is as follows:

$$\frac{40.91}{12} = \textit{4 general circuits*}$$

5 general circuits* and
3 isolated ground circuits

$$\frac{30}{12} = \textit{3 isolated ground circuits}$$

*Due to the cluster layout and the desktop copier, which has been designated to its own circuit (see Workstation #3 on "Electrical Planning Worksheet"), the number of general circuits used will be increased to five.

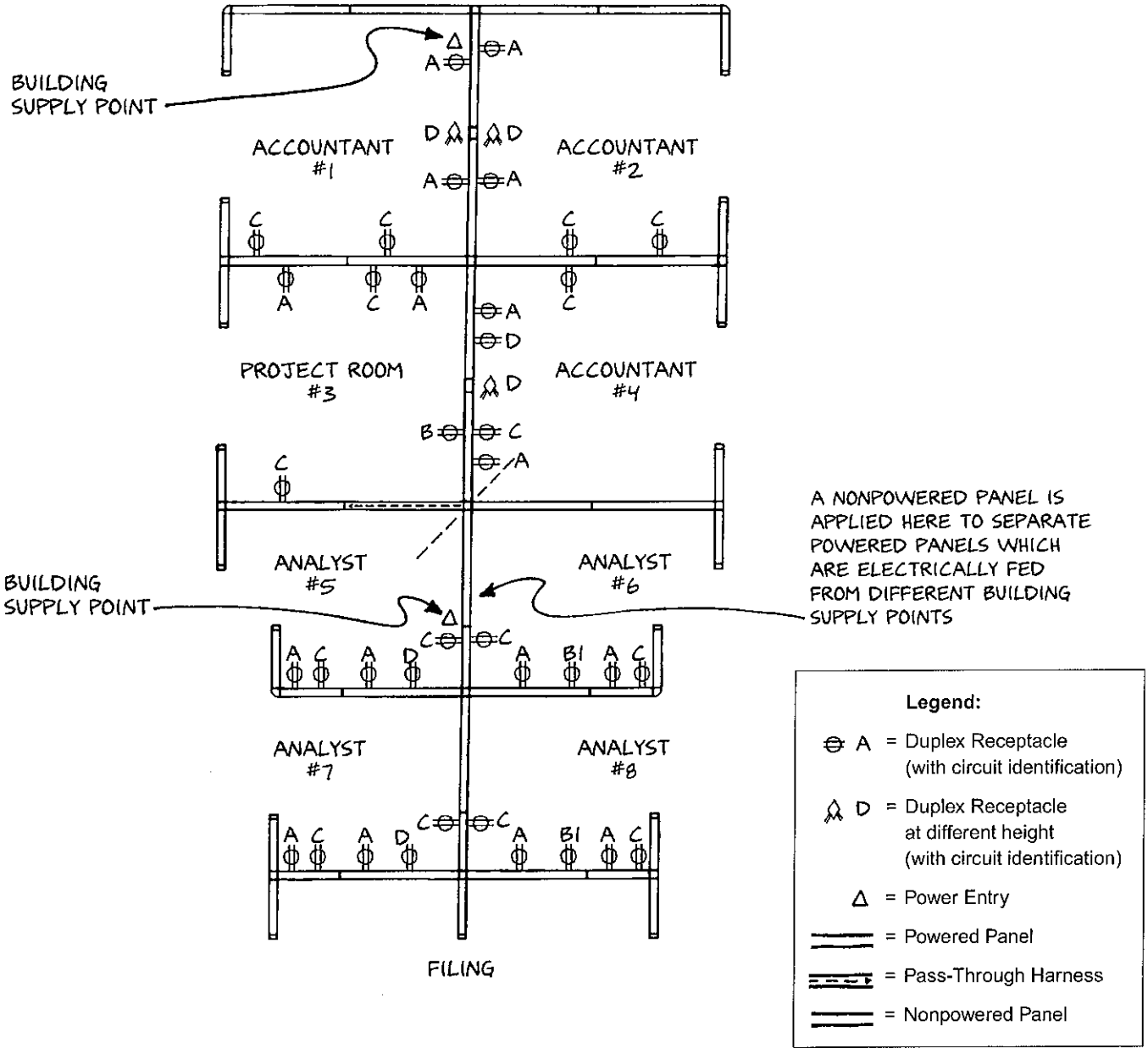


Identifying Powered Panels on the Floor Plan

It is important to identify panels as "powered" on the floor plan. These panels will deliver the electrical circuits from the building's supply point to the receptacle locations. It is also at this point that cable management panels can be identified on the floor plan—at any location where energy distribution or access is desired above the baseline.

Panels are identified in one of three ways:

1. Powered—electrical distribution with receptacle access
2. Pass-through—electrical distribution with no receptacle access
3. Nonpowered—no electrical distribution

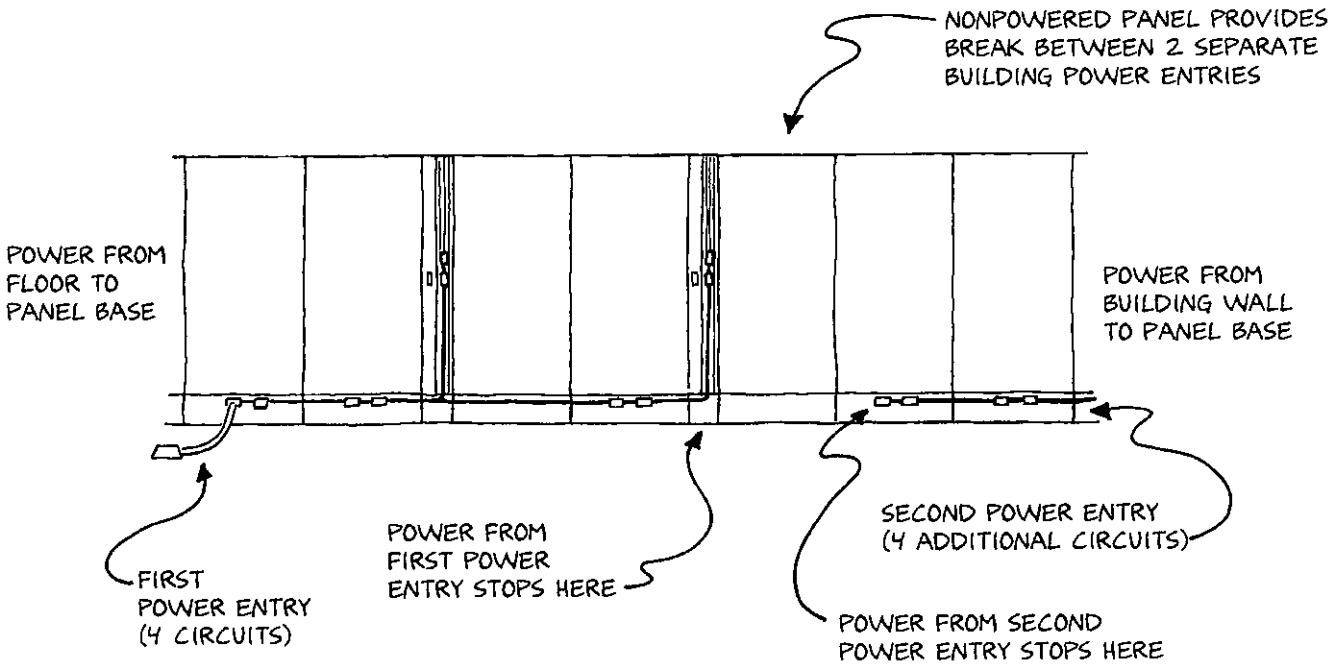


Step Four—Electrical Supply

Power is connected from the building electrical supply points to Action Office Series 2 panels by means of power entry products. These are available in two types: base feed (either direct connect or through a junction box) and ceiling feed. The product chosen depends on the site of interface between the building and the Action Office system.

Planning for a Second Infeed

After determining the number of circuits needed, it may be necessary to plan for additional circuits. In many cases, only one power entry point is required, due to the small number of workstations in an isolated cluster. However, in the floor plan example, the number of circuits required is eight. Assuming that the building is able to deliver up to four circuits at each electrical supply point, two separate power entries are required to power the cluster. A nonpowered panel can be used to separate two different infeeds to create a power break.



Usually, the most efficient way to access power is to run electricity through central spines and pull power into workstations or branches of workstations where needed. The advantage in the use of spines is the ability to run power from both sides of the spine if needed. (Not only is this usually most cost-effective, it can offer an additional advantage when planning for data and telecommunications cabling, which often shares the raceway with the electrical system. Because a spine often represents the shortest distance from entry point to workstation, it can be an important factor for certain types of cabling whose quality of transmission tends to deteriorate over long distances.)

Power Entry Points on the Floor Plan

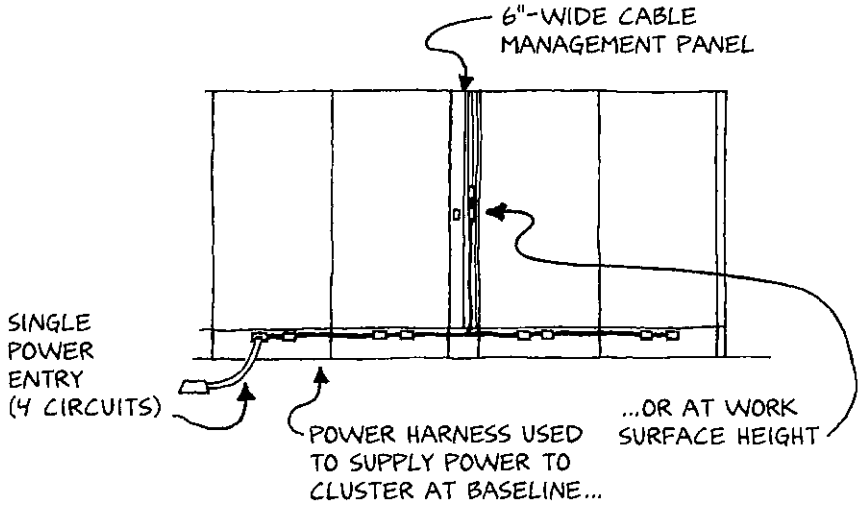
The locations and types of power entry points to supply the cluster of workstations must be identified on the floor plan. If a second infeed is required to power the remaining workstations, it is important to remember that harnesses powered by the first infeed must *never* be electrically connected to harnesses from the second infeed. If such harnesses are electrically connected, there is a risk of fire or electrical shock. (See "Key Regulations" earlier.)

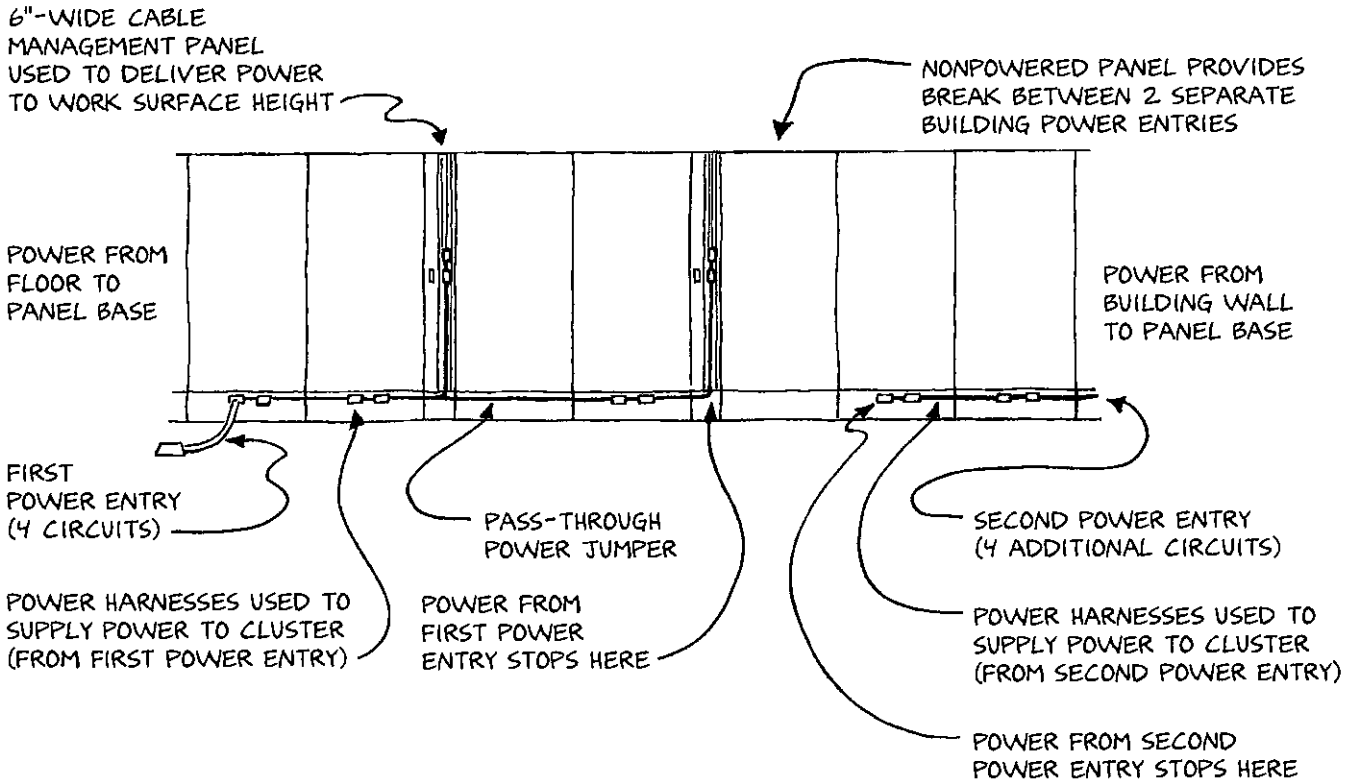
Summary of Electrical Supply

These two drawings illustrate the transfer of power from the building to the Series 2 panels with either one infeed or two. Note how, in the second drawing, a nonpowered panel is used to assure that the two infeeds are never electrically connected to one another.

Warning: All power sources must be disconnected prior to servicing. No single circuit may be powered by more than one source.

When more than one power entry is required to power a cluster of workstations, harnesses from the first infeed must *never* be electrically connected to harnesses from another infeed.





Electrical Planning Checklist

Keep these key points in mind when planning for a facility's electrical needs with this Herman Miller power system.

- Plan circuits based on the actual amperage draw, not on the maximum number of receptacles allowed.
- Accommodate future needs by being conservative in the initial circuit loading (10 to 12 amps per circuit on a 20-amp breaker, or fewer on a 15-amp breaker).
- Never exceed the maximum circuit capacities or local code limitations.
- *Know your local codes!* They always take precedence.
- Observe continuous-loading limitations (80 percent circuit capacity for devices with three-hour-plus continuous operation).
- Determine dedicated, isolated ground, and general circuit needs; plan accordingly for loads and infeeds.
- Try to balance loads between circuits.
- Never exceed the maximum number of receptacles allowed (13 duplexes per circuit, or per appropriate local code restrictions—whichever is the lower number).
- If a single piece of equipment draws more than 80 percent of the available amperage, make sure it is the only device connected to that circuit.
- When using a cable management panel, make sure hanging components, like shelves and work tools, do not cover receptacles located above the work surface height; also be sure that individual adjustments to the work surface height—especially with the height-adjustable work surface—do not interfere with access to those receptacles.
- Always have electrical layout plans and installations reviewed by a licensed electrician or electrical inspector to ensure that they meet all code requirements.
- *Never* electrically connect harnesses from one infeed to harnesses from another infeed.

Electrical Products

Planning Step	Product	Comments
1. Electrical Needs		Use "Electrical Planning Worksheet"; use typical amperage guidelines only when exact requirements for specific equipment are unavailable.
2. Electrical Access	Receptacles	For four-circuit, eight-wire system; designed to access circuit *a, b, c,* or *d*; 15 or 20 amps; also options for isolated ground and isolated ground with surge suppression. Be certain which circuits will be live (hooked up to the building) before receptacles are specified.
	Electrical Distributor, Multi-Outlet and 3-Outlet; Power Center; and Outlet Strip	Electrical distributor, provides 3 or 6 additional 3-prong standard 15-amp receptacles at work surface height; uses one baseline receptacle; power center, alternative to electrical distributor when communication ports also required; provides up to 4 duplex receptacles and 6 communication ports.
3. Electrical Distribution	Powered Panels	One-piece harness; shipped installed at panel base; distributes power horizontally along panel base; no other electrical components required for any type of connection.
	Cable Management Panel Frame (with Panel Faces)	Provides vertical chase to bring power vertically from the baseline to work surface height; vertical septum provides separation for power and communication cables; provides 2 duplex receptacle locations above the work surface (1 on the 39"-high panel) on each side; also provides 3 communication port locations on each side.
	Base Power Adapter	Field retrofitted to nonpowered panels to convert panels to powered ones; specified with or without side covers. (Specify without side covers only if nonpowered panels have side covers with receptacle fillers on each side.)
	Panel Pass-Through Power Jumper	Extends power from baseline of powered panel through nonpowered panels to adjacent powered panel.
	Power Jumper	Connects power from baseline to work surface height within cable management panel frame; plugs into receptacle outlet on right of power harness.
	Harness End Cap	Covers unused end port or side port of electrical harness.
	Cable Management Troughs (AO381. and AO382.)	Suspend from panel or work surface to hold multiple-outlet electrical distributor, power center, and outlet strip.
	Cable Management Trough (AO383.)	Chase, attached with adhesive backing horizontally or vertically to panel or wall, to manage and conceal several electrical wires.
	Cable/Energy Barrier	Provides barrier to separate data cables and electrical wires within panel or connector.
4. Electrical Supply	Base Power Entry, Direct Connect	For floor, column, or wall building supply; connects to powered panel at receptacle location; distributes up to 4 20-amp circuits.
	Base Power Entry, Junction Box	For floor, column, or wall building supply; specified with nonpowered panels; no receptacle access; used where local codes require a hard-wired solution; distributes up to 4 20-amp circuits.
	Ceiling Power Entry, 4 Circuit (including Top-Mounted and Cable Management Panel)	For ceiling building supply; attaches to panel end, spacer, or corner connector; distributes up to 4 20-amp circuits; rigid conduit provides metal separation between electrical wiring and communications cabling; top-mounted power entry connects electrical supply to top-mounted voice/data cable channel or powered panel; cable management panel power entry connects electrical supply to base of powered panel.

Distribution of Energy

Once electrical needs have been determined, energy must be brought from the building into this furniture system for distribution through either the baseline or the cable management panel. At certain locations, electrical access points can be established with products that distribute energy horizontally and vertically through the system.

Power Entry

Power entries distribute electrical power from the building to the panel system. These are available in two types—a base feed (either directly or through a junction box) or a ceiling feed. The type of entry chosen depends on the site of interface between the building (floor, perimeter wall or column, or ceiling) and the Herman Miller systems products.

Power Entry Products

Entry Point	Types of Connection
Floor	• Direct Connect • Junction Box (hard-wired)
Perimeter (wall or column)	• Direct Connect • Junction Box (hard-wired)
Ceiling	• Ceiling Power Entry • Cable Management Panel Ceiling Power Entry • Top-Mounted Ceiling Power Entry

Caution: All electrical connections to the building power source *must* be made by a qualified electrician in accordance with all national and local codes.

Base Power Entry, Direct Connect, 4 Circuit
A1322.

Description
This power entry connects a building's electrical supply from a wall, floor, or column to the base of a powered four-circuit Action Office Series 2 panel or a Series 1 nonpowered panel retrofitted for four-circuit power. It plugs directly into a receptacle location on the panel's baseline electrical harness to distribute up to four 20-amp circuits. The power entry is manufactured in a right-hand direction but can be field converted to a left-hand direction. The cable is available in four lengths and can be field cut to the appropriate length. The power entry is UL listed and CSA certified.

Dimensions
Available in 6', 12', 18', and 24' lengths.

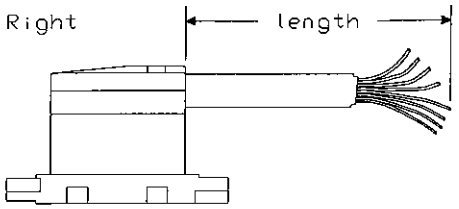
Planning Considerations
This power entry is used where local codes require a hard-wired power entry.

The power entry length should closely match the distance between the building's electrical supply and the receptacle location on the panel. The 12' to 24' lengths are recommended for downstream, multiple power supply from a single building entry point. (Special ground-contact terminals inside the liquid-tight conduit maintain the integrity of the ground function for these extended lengths.)

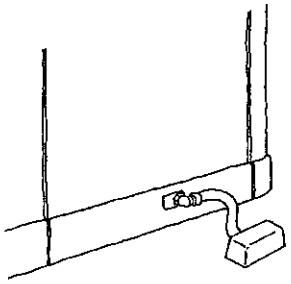
When a direct-connect power entry is used, receptacles can still be mounted in all other receptacle locations on the panel, including the one opposite the base power entry.

Energy can be distributed in either direction by setting the direction of the connection during installation or reconfiguration.

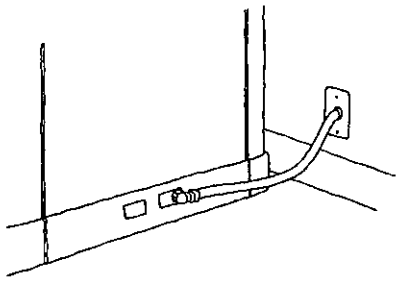
This power entry must be wired by a licensed electrician.



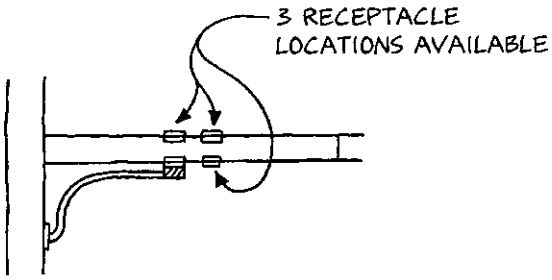
Top View

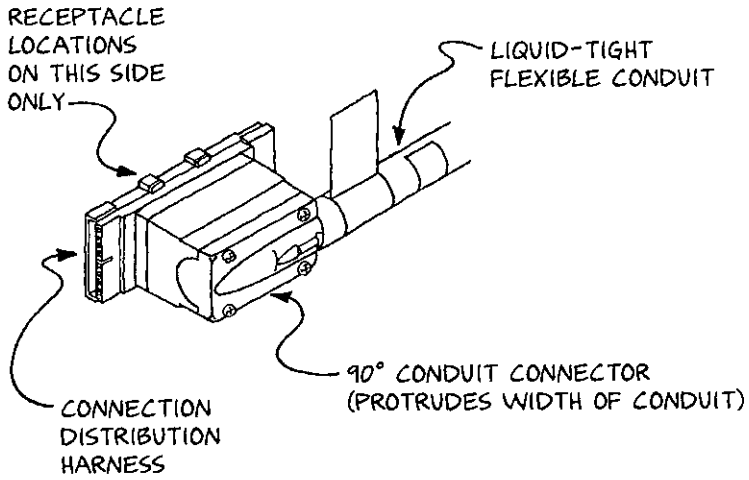


POWER FROM FLOOR TO PANEL BASE



POWER FROM BUILDING WALL TO PANEL BASE

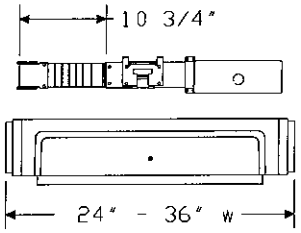


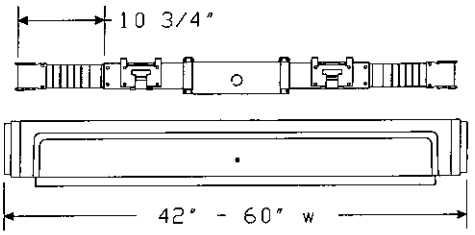


Limitations
Base power entry cannot be used on a 12"- or 18"-wide panel, since it has no receptacle locations in its base, nor on a 6"-wide cable management panel.

Base Power Entry, Junction Box, 4 Circuit
A1323.

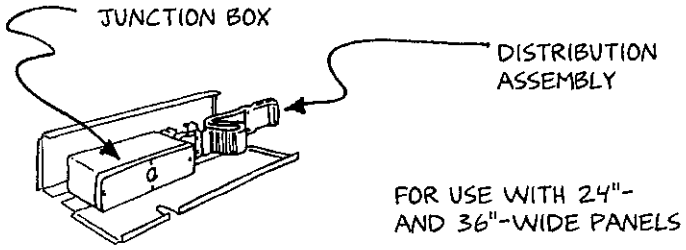
Description
This power entry connects a building's electrical supply from a wall, floor, or column to the base of a nonpowered Action Office Series 2 panel or a Series 1 nonpowered panel retrofitted for four-circuit power; it distributes up to four 20-amp circuits. It includes a junction box, an electrical harness, and an expanded side cover. The power entry also includes 6' of wire that can be field cut to the appropriate length for connection to the building's power. It does not provide receptacle access. The power entry is UL listed and CSA certified.





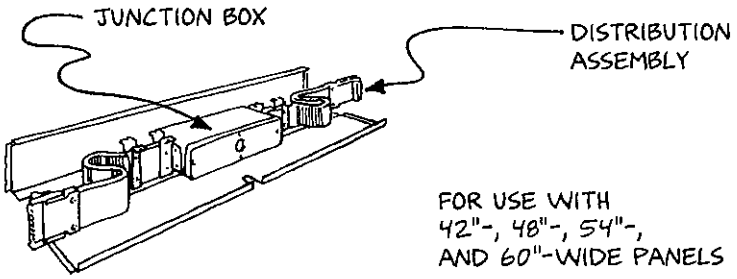
24"- to 36"-wide power entries have a 40-cubic-inch capacity and distribute power in one direction; 42"- to 60"-wide power entries have a 60-cubic-inch capacity and distribute power in both directions.

Dimensions
Available in widths to match standard 24", 30", 36", 42", 48", and 60" panel sizes.



Planning Considerations
This power entry is used where local codes require a hard-wired power entry.

The power entry width must match the width of the panel on which it will be used.

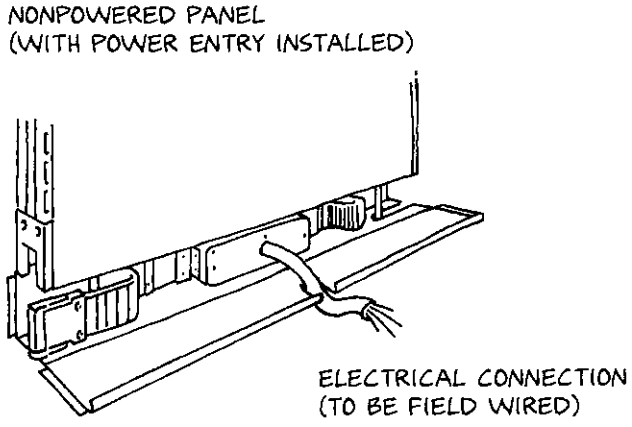


Power can be distributed only in the direction opposite the junction box in 24"- and 36"-wide panels. Since the hole in the side cover is off center, the cover determines the direction of power distribution and must be located on the correct side of the panel. Power in 42", 48", 54", and 60" panels can be distributed in both directions.

Exterior wires that connect the junction box to the building's electrical supply must be covered with conduit. A licensed electrician must supply and wire the conduit and the conduit connector. When local electrical codes require wiring connections inside the junction box, a licensed electrician must also wire the connection to the electrical harnesses.

Limitations
A junction box power entry cannot be used on a 12"- or 18"-wide panel, nor on a 6"-wide cable management panel.

The power entry must be field installed.



Ceiling Power Entry, 4 Circuit
A1331.

Description
This power entry connects a ceiling's electrical supply to the base of a powered four-circuit Action Office Series 2 panel or retrofitted Series 1 panel at the end of a panel run or at a three- or four-way 90° connector. It distributes up to four 20-amp circuits and holds up to 110 Category 5 cables. The power entry has a 10 1/2' pole, which can be field cut to the appropriate length; ceiling and base trim; a rigid conduit and conduit connector; and a factory-installed electrical harness. The rigid conduit encloses electrical wires and provides metal separation for voice/data cables. The power entry is UL listed and CSA certified.

Dimensions
Available to fit 47", 53", 62", 67", and 85" panel heights.

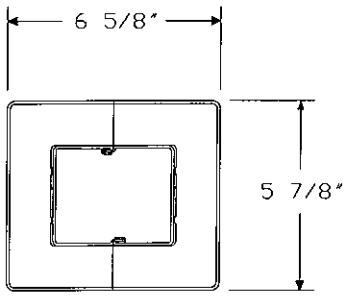
Exterior width of ceiling bezel is 7" (nominal); depth is 6" (nominal). Exterior width of power entry is 3 7/8"; depth is 3 1/8".

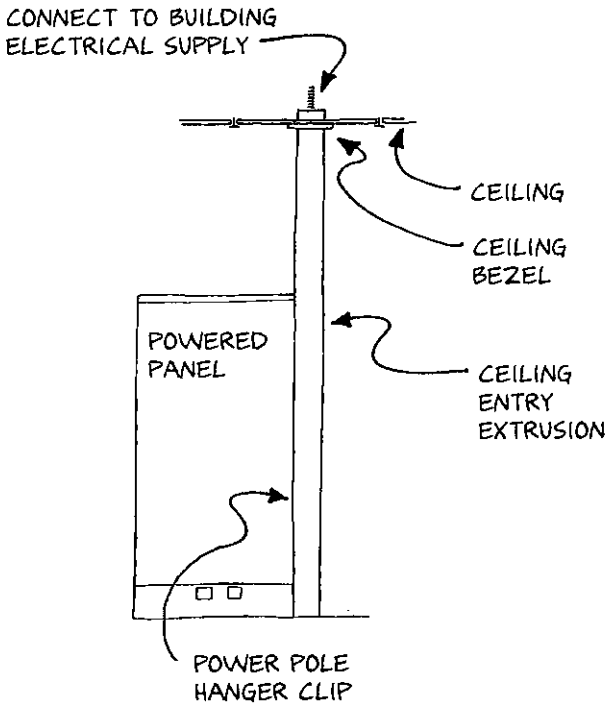
Interior cavity depth of both ceiling bezel and power entry is 2 3/4"; width is 1 1/2" with power and 3 1/2" without power.

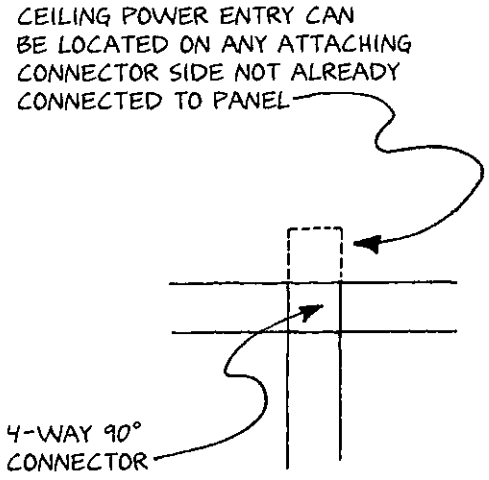
Planning Considerations
The ceiling power entry, when attached to a three-way or four-way 90° connector, can be used on any side of the connector not already attached to a panel; the product does not prevent the future connection of a panel in that same position on the connector.

The ceiling power entry is available in powered and nonpowered versions. The nonpowered version is used for voice/data cable entry only. The capacity of the power entry is 120 4-pair UTP Category 5 cables (without power) or 90 4-pair UTP Category 5 cables (with power).

The ceiling power entry can connect to a *nonpowered* panel if used only for voice/data cable entry.







Because the internal capacity of the nonpowered version of the power entry is greater than that of the panel baseline raceway, when the cables reach the panel base, they may need to be divided and routed in different directions.

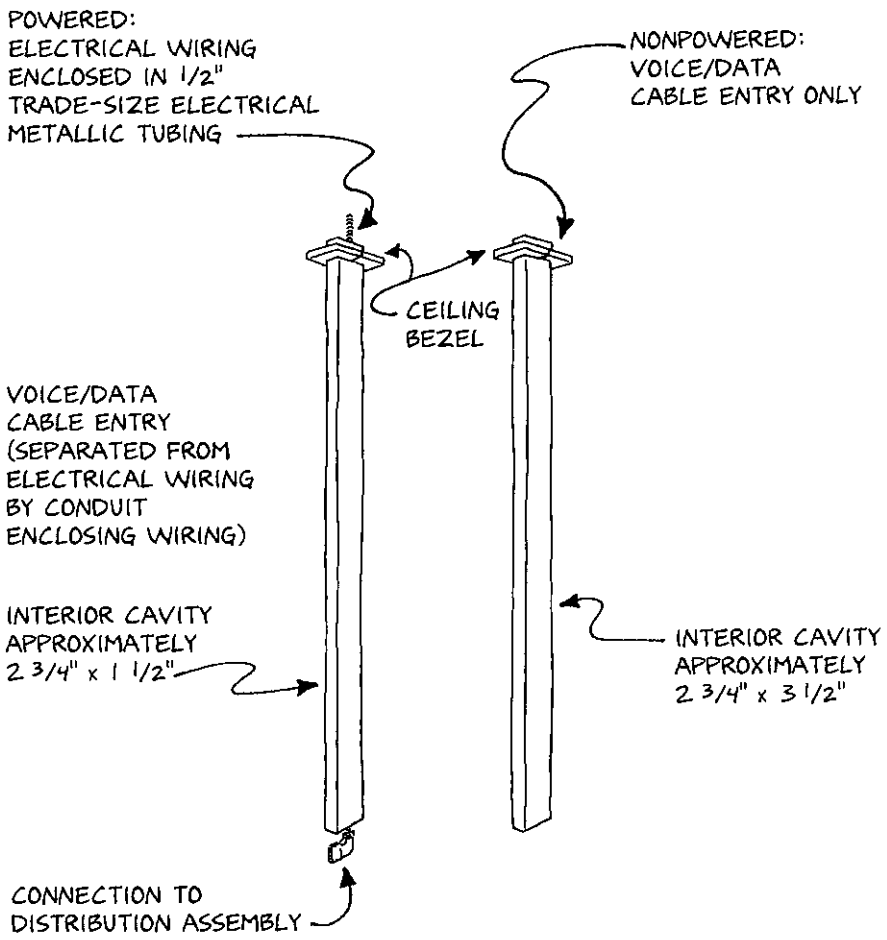
A 10 1/2' length of 1/2" trade-size electrical metallic tubing (knocked down) encloses the wiring up to the ceiling junction box.

The internal electrical harness must be installed in conduit as required by national codes.

The power entry must be properly wired by a licensed electrician, according to national and local code specification, with conduit in the ceiling terminating in a junction box.

Limitations
This power entry cannot be used with 32" and 39" panel heights.

This product cannot be used to provide access to the energy system or to the voice/data cabling.



CAPACITY—
WITHOUT POWER: 120 4-PAIR UTP CATEGORY 5 CABLES
WITH POWER: 90 4-PAIR UTP CATEGORY 5 CABLES

Ceiling Power Entry, 4 Circuit, Top Mounted
NP239.

Description
This power entry connects a ceiling's electrical supply to a top-mounted voice/data cable channel or Action Office Series 2 panel base or a Series 1 panel base with the four-circuit retrofit kit. It distributes up to four 20-amp circuits. The power entry has a 10 1/2' pole, which can be field cut to the appropriate length; ceiling and end cap trim; a rigid conduit and conduit connector; and a factory-installed electrical harness. The rigid conduit encloses electrical wires and provides metal separation for voice/data cables. The power entry is UL listed and CSA certified. Shipped knocked down.

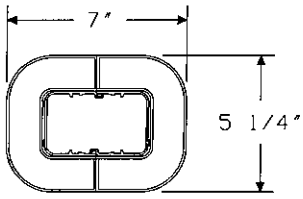
The power entry without power holds up to 120 4-pair Category 5 cables; the power entry with power holds up to 90 4-pair Category 5 cables.

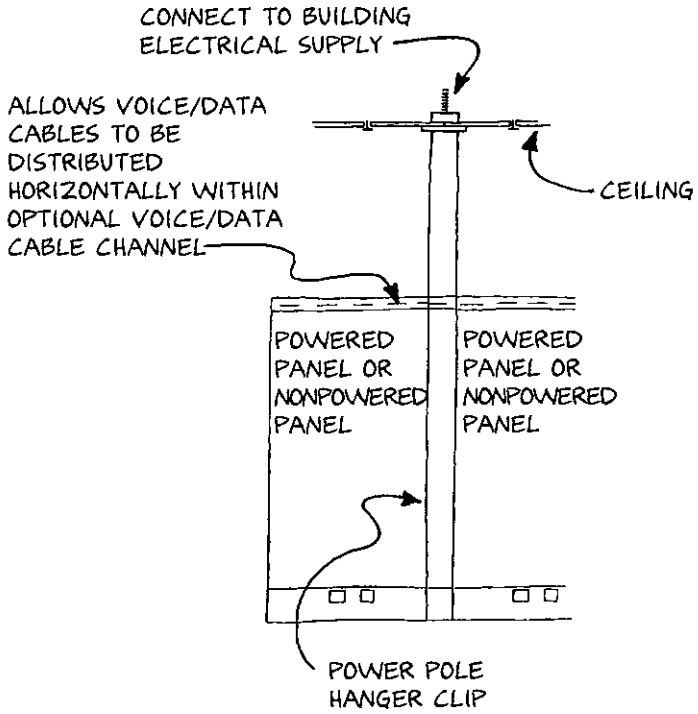
Dimensions
Available to fit 47", 53", 62", 67", and 85" panel heights.

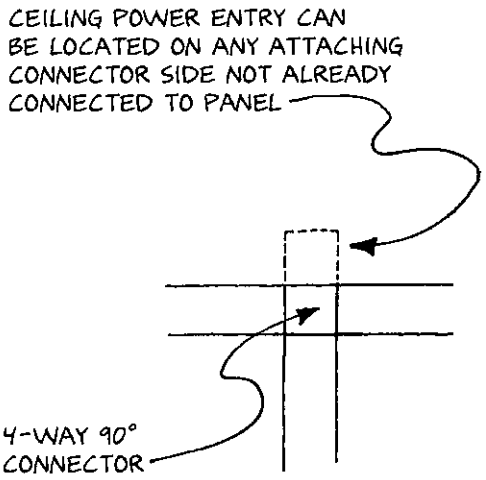
Exterior width is 7" (nominal); depth is 5 1/4" (nominal). Interior cavity width is 2 3/4"; depth is 1 1/2" with power and 3 1/2" without power.

Planning Considerations
This ceiling power entry has an opening at the same height as the adjacent panel height that allows the voice/data cables to be distributed horizontally within the optional voice/data cable channel along the top of the panel.

The ceiling power entry can be used at the end of a panel run or attached to a connector within a panel run. When attached to a three-way or four-way 90° connector, this ceiling power entry can be used on any side of the connector not already attached to a panel; the product does not prevent the future connection of a panel in that same position on the connector.







The ceiling power entry is available in powered and nonpowered versions. The nonpowered version is used for voice/data cable entry only. The capacity of the power entry is 120 4-pair UTP Category 5 cables (without power) or 90 4-pair UTP Category 5 cables (with power).

The ceiling power entry can connect to a *nonpowered* panel if used only for voice/data cable entry.

Because the internal capacity of the nonpowered version of the power entry is greater than that of the panel baseline raceway, when the cables reach the panel base, they may need to be divided and routed in different directions.

A 10 1/2' length of 1/2" trade-size electrical metallic tubing (knocked down) encloses the wiring up to the ceiling junction box.

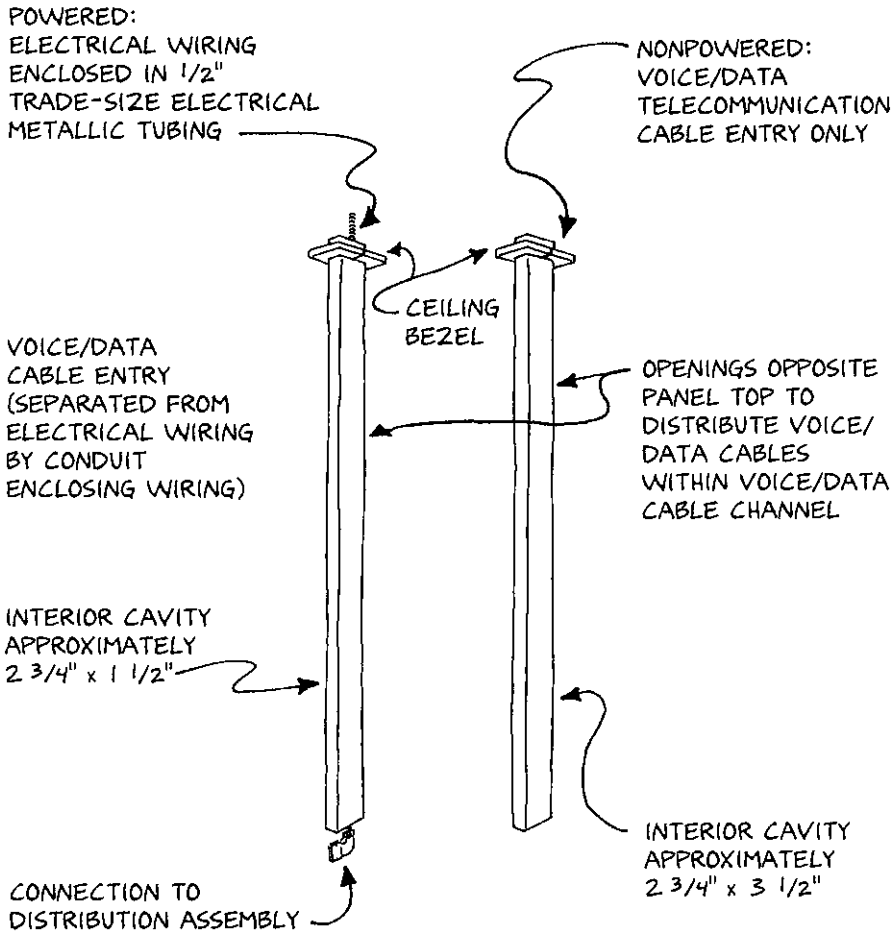
The internal electrical harness must be installed in conduit as required by national codes.

The power entry must be properly wired by a licensed electrician, according to national and local code specification, with conduit in the ceiling terminating in a junction box.

Limitations

This power entry cannot be used with 32" and 39" panel heights.

This product cannot be used to provide access to the energy system or to the voice/data cabling.



Ceiling Power Entry, Cable Management Panel
A1332.

Description
This 6"-wide power entry connects a ceiling's electrical supply to the base of a powered panel and distributes up to four 20-amp circuits. It has a structural frame that holds a cable management panel face on each side; an extender, which can be cut to the appropriate length; ceiling and base trim; rigid conduit; connecting hardware; and a factory-installed electrical harness. The conduit encloses electrical wires and provides metal separation for voice/data cables. The maximum height of the power entry is 10'-6". Power cannot be accessed through the frame. The power entry is UL listed and CSA certified.

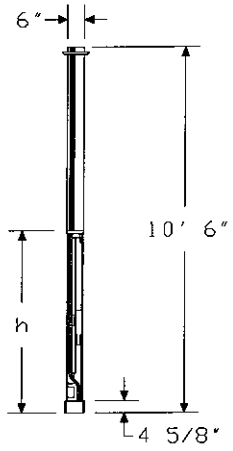
Dimensions
Available in 39", 47", 53", 62", 67", and 85" heights (excluding extender).

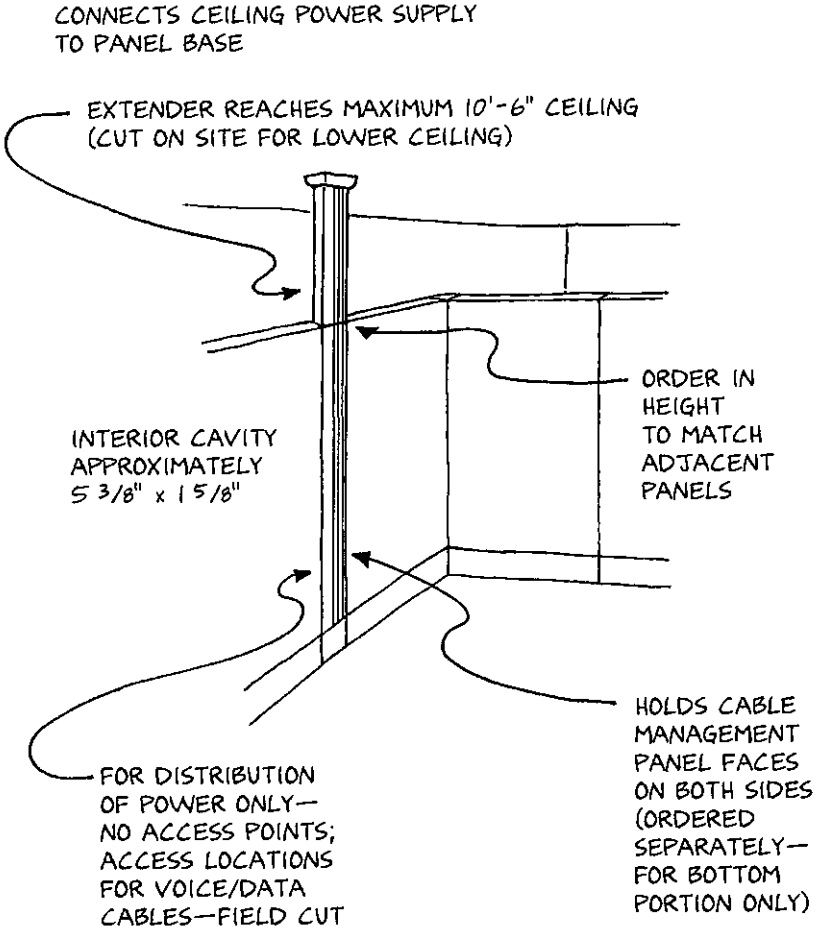
Width is 6".

Interior cavity width is approximately 5 3/8"; depth is 1 5/8".

Planning Considerations
The ceiling power entry can be located anywhere in a panel run except at the end, because it cannot accept a finished end or a change-of-height finished end.

The ceiling power entry is also available without the electrical assembly for entry of voice/data cables only. When used for only voice/data cables, it can attach at the base to a nonpowered panel.





Order this ceiling power entry to match the height of the adjacent panels; it comes with the appropriate-length extender to reach a 10'-6" ceiling. (For lower ceilings, the extender can be cut to size on site.) Because this ceiling power entry serves as a power distribution component only, there is no electrical access, so the nonpowered cable management panel face should be specified, separately. If access *is* desired to the voice/data cables, ports can be custom cut in the panel face on site.

The cable capacity for the nonpowered version is 48 4-pair UTP Category 5 cables; the capacity for the powered version is 36 4-pair UTP Category 5 cables. The power entry can be uncovered for easy installation of cables.

To connect the power entry to a panel, order a draw rod separately. To connect the power entry to a connector, no additional parts are needed. (The connector includes the attachment hardware.)

The ceiling power entry must be wired by a licensed electrician, and the ceiling junction box must be supplied by a licensed electrician.

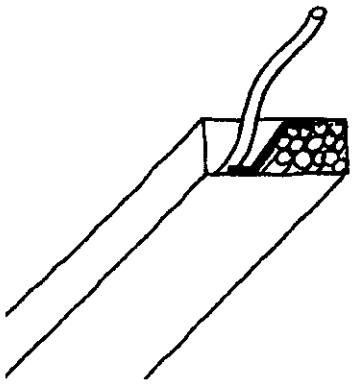
Options

To connect the cable management panel ceiling power entry to an adjacent panel, order the Draw Rod (AO214.) separately.

Order the Cable Management Panel Face, Side 1 (A1181.), and the Cable Management Panel Face, Side 2 (A1182.), separately, to enclose the 6"-wide panel frame.

Limitations

This product cannot be used to provide access to the energy system; access to voice/data cabling must be field cut.



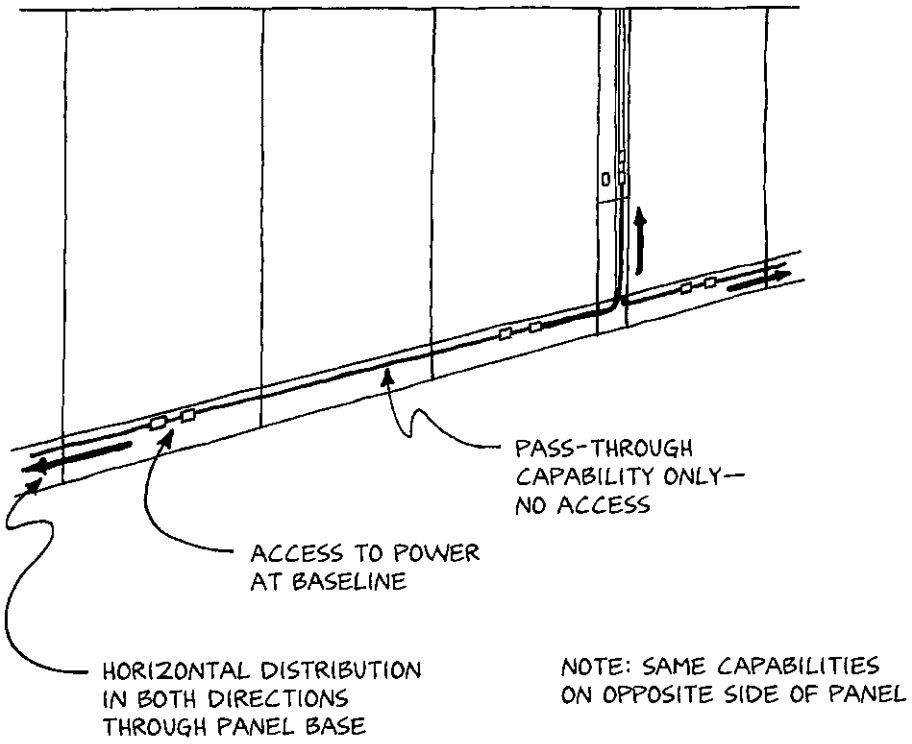
DISTRIBUTES UP TO 4 20-AMP CIRCUITS (POWERED VERSION ONLY) AND VOICE/DATA CABLES

Baseline Distribution

The baseline is the primary location for carrying power horizontally from the point of power entry to places throughout the facility where electricity is needed. The distribution can be from one or more building access points.

Baseline power can be distributed in three directions: left and right (through the baseline) and vertically (through the cable management panel).

All baseline energy distribution is concealed behind the hinged cover assembly. Receptacles can be installed for access to power from either side of the panel.



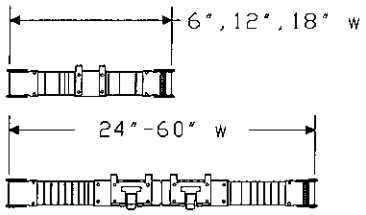
Base Power Adapter, 4 Circuit
A1354. Side Covers
A1355. No Side Covers

Description
This power adapter converts a nonpowered panel to a powered panel. It has an electrical harness that distributes up to four 20-amp circuits. The power adapter is UL listed and CSA certified.

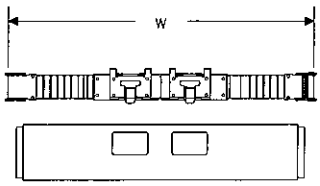
The power adapter with side covers includes receptacle fillers.

6"- to 18"-wide power adapters have no receptacle locations; 24"- to 60"-wide power adapters have two receptacle locations per side.

Dimensions
Available in 6", 12", 18", 24", 30", 36", 42", 48", and 60" widths to match standard panel sizes.



No Side Covers



Side Covers

Planning Considerations
This product is available with or without side covers, depending on whether the panel to be converted already has side covers with receptacle locations in place. (If so, the power adapter without side covers is the appropriate choice.)

The 6"-wide base power adapter allows power to pass through a nonpowered cable management panel at the baseline, but it does *not* provide it with the capability of delivering power to the work surface.

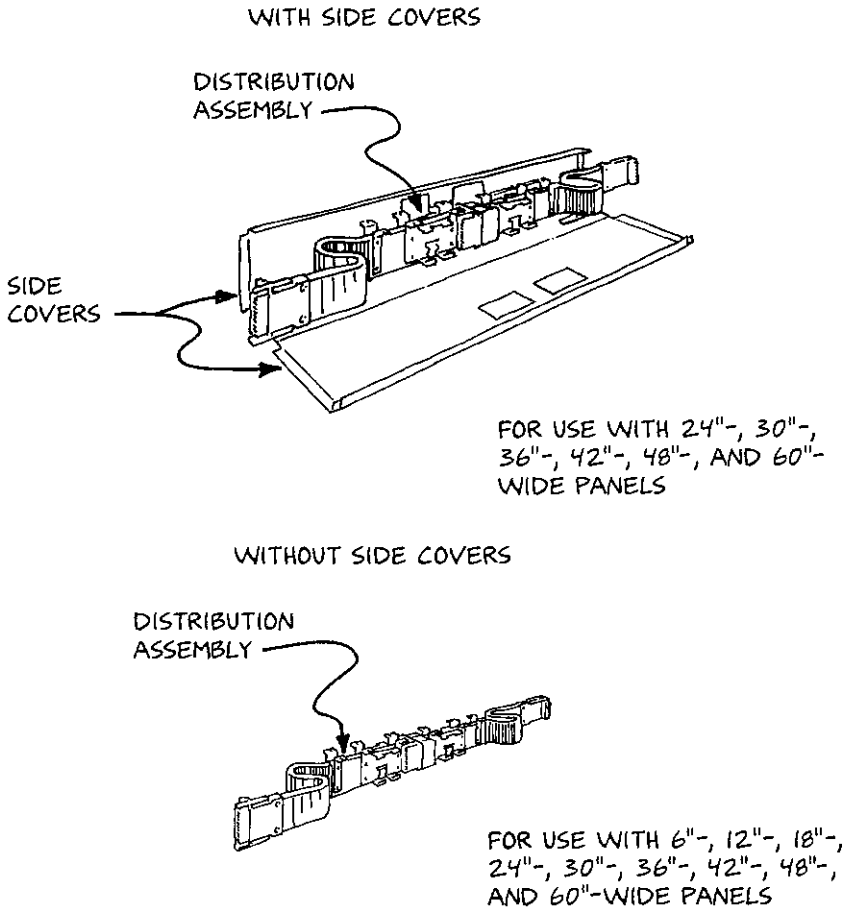
The power adapter is available with or without a metal barrier for separation of electrical and voice/data cables. (The barrier is not available on the 6"-wide base power adapter.)

The power adapter does not include receptacles.

The power adapter must be field installed.

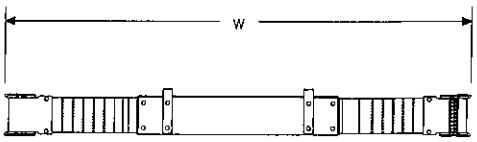
Options
Order the Receptacle, 4 Circuit, 15 Amp (A1311.), or Receptacle, 4 Circuit, 20 Amp (X1311.), separately.

Limitations
The base power adapter with side covers is not available for the 6"-wide cable management panel or 12"- or 18"-wide panels.

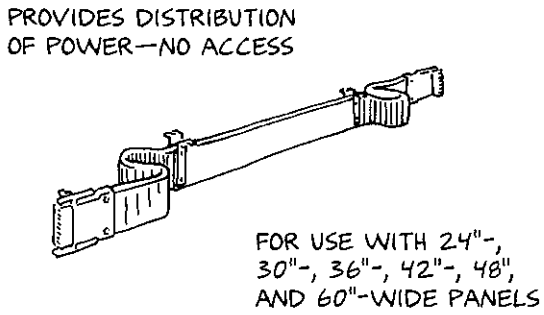


Panel Pass-Through Power Jumper
A1342.

Description
This harness extends power from a powered panel through a nonpowered panel to an adjacent powered panel. It does not provide receptacle access. The power jumper is UL listed and CSA certified.



Dimensions
Available in 24", 30", 36", 42", 48", and 60" widths to match standard panel sizes.



Planning Considerations
Power jumpers are not available for 6"-, 12"-, or 18"-wide panels. To distribute power through a nonpowered 6"-wide cable management panel or a 12"- or 18"-wide panel completing a panel run, the panel can be retrofit with a base power adapter.

There is no limit to the number of pass-through power jumpers that can be attached together.

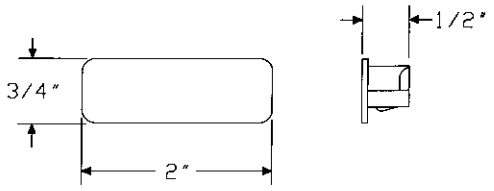
The power jumper must be field installed.

Limitations
The power jumper does not provide receptacle access.

The power jumper is not available to fit the 6"-wide cable management panel frame or 12"- and 18"-wide panels.

Harness End Cap
B1358.

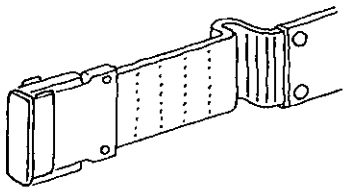
Description
This cap covers the unused end port or side port of an electrical harness. It also serves as a visual indicator for the last harness in a series of powered products. Cap is red. Package contains 10.



Dimensions
Height is 2".

Width is 3/4".

Depth is 1/2".



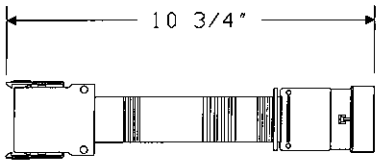
Planning Considerations
The harness end cap helps ensure against accidentally connecting harnesses from more than one power entry, especially during reconfigurations.

The harness end cap can be removed later if the electrical distribution is to continue to an adjacent harness.

The city of Los Angeles requires end caps on all unused harness ends.

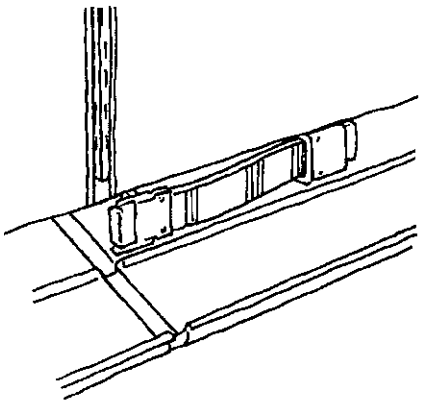
Electrical Bridge
A1370.

Description
This bridge connects an electrical harness with the *E* power option to an electrical harness with the *D* power option. It is UL listed and CSA certified. Package contains five.



Dimensions
Width is 10 3/4".

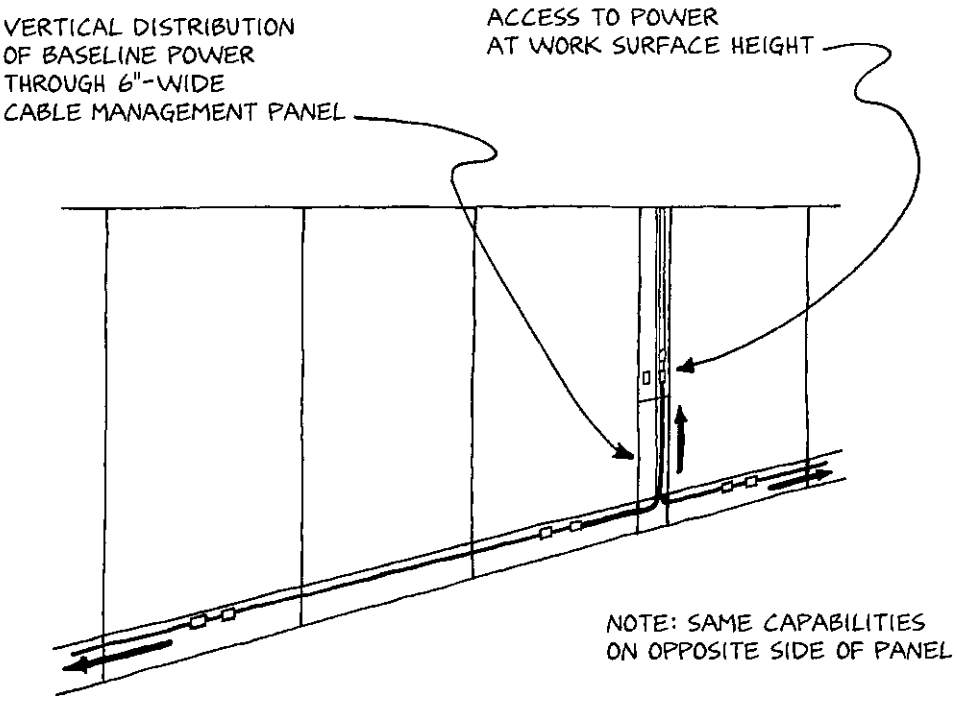
Planning Considerations
This bridge connects an earlier version (D) of the four-circuit energy system to a newer version (E) of the four-circuit system for uninterrupted energy distribution through the system. (Once the flexible electrical connector is removed from the old system, the electrical bridge is snapped into the power block of the old system and the end of the power harness of the new system.)



Vertical Distribution

Baseline power is distributed vertically through the cable management panel to predetermined access locations just above the work surface. (The cable management panel, if desired, can also distribute voice/data cables—physically separated from power transmissions by a metal septum.)

The wires (and cables) are concealed between segmented panel faces that fit over both sides of the panel frame and provide access to power from either side of the cable management panel.



Electrical Access

The primary means of electrical access in this Herman Miller four-circuit energy system is the receptacle; while most receptacles in the system are duplex, the isolated ground with surge suppression is a simplex receptacle—whether for circuits *b* or *c* or the dedicated circuit *d*.

When receptacles are installed, access to power is available from that side of the panel through cutouts in either the base or the cable management panel. When receptacles are installed on both sides, power access is available from one or both sides of the panel.

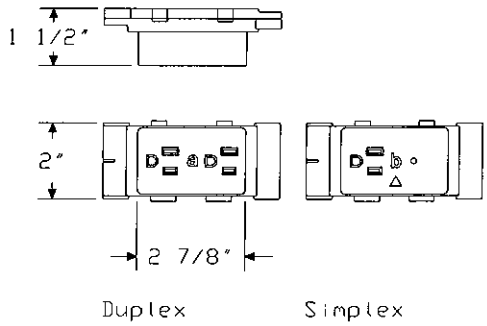
Receptacles can also be provided at the work surface, either mounted to its underside, fitted in a trough, or placed in a bracket on top of the surface. With the power center and the multi-outlet electrical distributor, up to six receptacles can be grouped in a single unit; and with the power center, receptacles and communication ports can be combined in the same unit.

Receptacles are available at 15- or 20-ampere ratings (although not every component offers both). They are marked to signify which circuit they access, as well as to show isolated ground capability.

For a detailed discussion of receptacle capacities and planning considerations, see "Circuit Capacity and Configurations," "Key Regulations," and "Planning Process Overview" in this "Energy Distribution" section.

Receptacle, 4 Circuit, 15 Amp
A1311.

Description
This receptacle locks into the baseline harness of an Action Office Series 2 panel, the stretcher of an Arrio work surface, or a Liaison cabinet in a back-to-back configuration. It is UL listed and CSA certified.



A duplex receptacle package contains six receptacles; a simplex receptacle package contains one.

Dimensions
Height is 2".

Overall width is 4 5/8".

Depth is 1 1/2".

Planning Considerations
Receptacles for this four-circuit, eight-wire system are designed to access circuit *a*, *b*, *c*, or *d*. Optional isolated ground and isolated ground with surge suppression versions are also available for the *b*, *c*, and *d* circuits; each of these has orange circuit letters as well as an orange triangle to facilitate user identification.

The types of receptacles available, along with the circuits they access, are shown on the chart below:

Circuit Type	Description
A	Duplex, circuit a
B	Duplex, circuit b
C	Duplex, circuit c
D	Duplex, circuit d, isolated ground
BI	Duplex, circuit b, isolated ground
CI	Duplex, circuit c, isolated ground
BIS	Simplex, surge suppression, circuit b, isolated ground
CIS	Simplex, surge suppression, circuit c, isolated ground
DIS	Simplex, surge suppression, circuit d, isolated ground

If any of the isolated ground receptacles (*BI*, *CI*, etc.) are used, they access the same neutral and ground as the *d* circuit and consequently negate the dedicated function of the *d* circuit.

A *BI* receptacle should never be used on the same circuit with a *b* receptacle, and vice versa; and a *CI* receptacle should never be used on the same circuit with a *c* receptacle, and vice versa.

The optional surge suppression is designed to provide added protection from the hazards of power surges; this is especially critical for computers or other sophisticated equipment. The receptacle contains integrated components, which provide the protection, as well as an LED (Light-Emitting Diode) for visual indication of proper operation; if the LED fails to light, it means the surge suppression capability has been exhausted and the receptacle should be replaced.

The advantage that surge-suppression receptacles offer over a centrally protected electrical system is that electrical equipment is protected not only from outside power surges but also from power surges that occur inside the building. They also protect equipment using the same circuits from affecting each other.

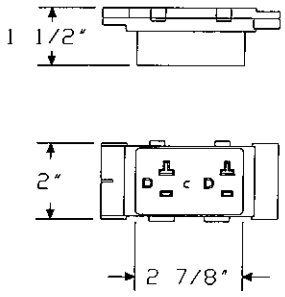
Surge suppression is provided by three metal oxide varistors (MOVs) mounted on a small circuit board. The specifications for the surge-suppression capability are these:

- Transient energy—70 joules maximum
- Transient peak current—6500 amps maximum
- Clamping voltage—340 volts maximum at 50 amps

Note: The surge-suppression receptacle is UL listed, based on UL 1449 standard for transient voltage suppressors.

All receptacles are duplex (two plugs), except for the isolated ground with surge suppression, which is simplex (one plug)—whether for circuits *b* or *c* or the dedicated circuit *d*.

Receptacle, 4 Circuit, 20 Amp
X1311.



Description
This receptacle locks into a four-circuit electrical harness to provide power to equipment with a 20-amp standard plug head. It also accepts 15-amp standard plug heads. The receptacle is UL listed and CSA certified.

Dimensions
Height is 2".

Overall width is 4 5/8".

Depth is 1 1/2".

Planning Considerations
This receptacle is designed for components that require more power than 15-amp receptacles can provide.

The total connected load for this receptacle should not exceed 16 amps. (If one piece of equipment requires all available power, the receptacle's second outlet should not be used; additional receptacles can be installed on that circuit. In many cases, equipment requiring this receptacle will use all available power.)

Receptacles for this four-circuit, eight-wire system are designed to access circuit *a*, *b*, *c*, or *d*. Optional isolated ground versions are also available for the *b*, *c*, and *d* circuits; each of these has orange circuit letters as well as an orange triangle to facilitate user identification.

The types of receptacles available, along with the circuits they access, are shown on the chart below:

Circuit Type	Description
AT	Circuit a
BT	Circuit b
CT	Circuit c
DT	Circuit d, isolated ground
BIT	Circuit b, isolated ground
CIT	Circuit c, isolated ground

If any of the isolated ground receptacles (*Bl*, *Cl*, etc.) are used, they access the same neutral and ground as the *d* circuit and consequently negate the dedicated function of the *d* circuit.

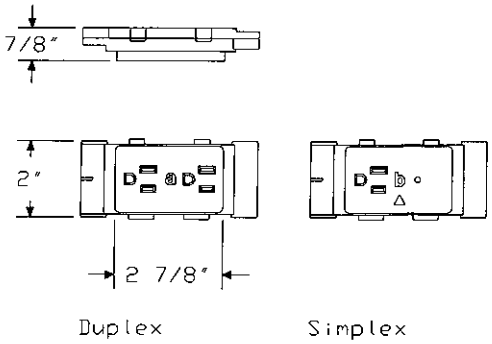
A *Bl* receptacle should never be used on the same circuit with a *b* receptacle, and a *Cl* receptacle should never be used on the same circuit with a *c* receptacle.

All receptacles are duplex (two plugs)—whether for circuits *b* or *c* or the dedicated circuit *d*.

Limitations
When the receptacle is locked into the baseline harness of an Action Office Series 3 powered panel, the receptacle extends 5/8" from the trim cover.

Receptacle, 4 Circuit, 15 Amp
K1311.

Description
This receptacle locks into the electrical harness of an Action Office Series 3 powered panel, a Liaison powered cabinet, an Arrio powered work surface, or an Action Office Series 2 or 3 powered cable management panel frame to provide power to equipment with a 15-amp standard plug head. The receptacle is UL listed and CSA certified.



A duplex receptacle package contains six receptacles; a simplex receptacle package contains one.

Dimensions
Height is 2".

Overall width is 4 5/8".

Depth is 7/8".

Planning Considerations
Receptacles for this four-circuit, eight-wire system are designed to access circuit *a*, *b*, *c*, or *d*. Optional isolated ground and isolated ground with surge suppression versions are also available for the *b*, *c*, and *d* circuits; each of these has orange circuit letters as well as an orange triangle to facilitate user identification.

The types of receptacles available, along with the circuits they access, are shown on the chart below:

Circuit Type	Description
A	Duplex, circuit a
B	Duplex, circuit b
C	Duplex, circuit c
D	Duplex, circuit d, isolated ground
BI	Duplex, circuit b, isolated ground
CI	Duplex, circuit c, isolated ground
BIS	Simplex, surge suppression, circuit b, isolated ground
CIS	Simplex, surge suppression, circuit c, isolated ground
DIS	Simplex, surge suppression, circuit d, isolated ground

If any of the isolated ground receptacles (*BI*, *CI*, etc.) are used, they access the same neutral and ground as the *d* circuit and consequently negate the dedicated function of the *d* circuit.

A *BI* receptacle should never be used on the same circuit with a *b* receptacle, and vice versa; and a *CI* receptacle should never be used on the same circuit with a *c* receptacle, and vice versa.

The optional surge suppression is designed to provide added protection from the hazards of power surges; this is especially critical for computers or other sophisticated equipment. The receptacle contains integrated components, which provide the protection, as well as an LED (Light-Emitting Diode) for visual indication of proper operation; if the LED fails to light, it means the surge suppression capability has been exhausted and the receptacle should be replaced.

The advantage that surge-suppression receptacles offer over a centrally protected electrical system is that electrical equipment is protected not only from outside power surges but also from power surges that occur inside the building. They also protect equipment using the same circuits from affecting each other.

Surge suppression is provided by three metal oxide varistors (MOVs) mounted on a small circuit board. The specifications for the surge-suppression capability are these:

- Transient energy—70 joules maximum
- Transient peak current—6500 amps maximum
- Clamping voltage—340 volts maximum at 50 amps

Note: The surge-suppression receptacle is UL listed, based on UL 1449 standard for transient voltage suppressors.

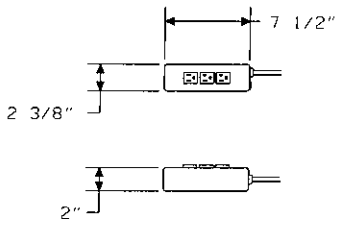
All receptacles are duplex (two plugs), except for the isolated ground with surge suppression, which is simplex (one plug)—whether for circuits *b* or *c* or the dedicated circuit *d*.

Liaison cabinets placed back to back require the A1311. four-circuit receptacle rather than the K1311. receptacle.

For Action Office Series 2 panels: When specifying receptacles for the Action Office Series 2 cable management panel frame, order the four-circuit receptacle (K1311.); when specifying them for all other Series 2 panels, order the four-circuit receptacle (A1311.) or the 20-amp four-circuit receptacle (X1311.).

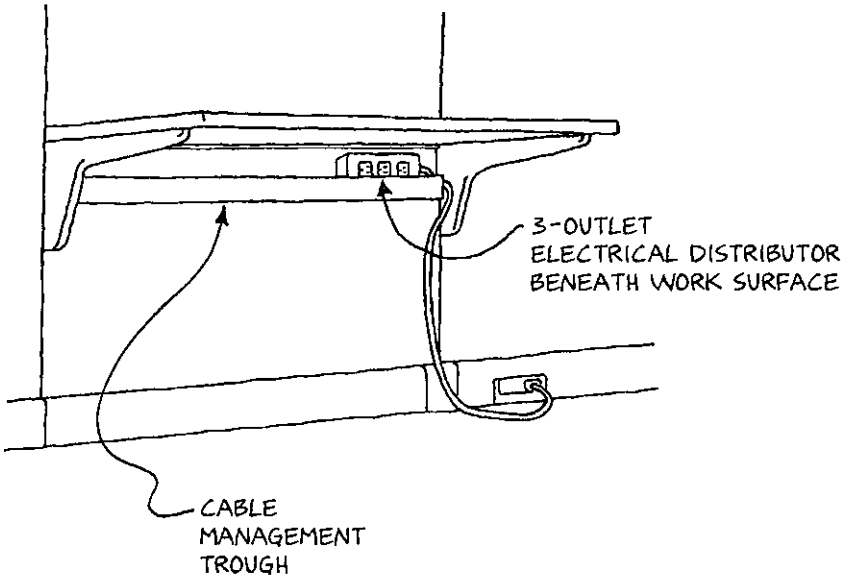
Electrical Distributor, 3 Outlet
G1313.

Description
This electrical distributor attaches to an Action Office panel-suspended cable management trough or Ethospace cable management trough or fits in a Newhouse Group cable management channel, an Arrio electrical distributor bracket, or the stretcher on an Arrio work surface. It provides additional receptacles at work surface height and has three standard, three-prong receptacles with a 15-amp circuit breaker. The electrical distributor is UL listed and CSA certified.



Dimensions
Width is 7 1/2"; depth is 2 3/8".

Planning Considerations
Placing the multi-outlet electrical distributor at work surface height allows easy access for users; this is especially helpful to workers with reach limitations. Placing the electrical distributor below the work surface makes the receptacles slightly less accessible, but hides them from view.



To use the electrical distributor above an Arrio work surface, order an Arrio electrical distributor bracket. Ethospace work surfaces, Arrio table desks, and Newhouse Group table desks have integral channels that will hold the electrical distributor; they require no additional components. To use the electrical distributor below the work surface height, use an Action Office cable management trough.

The distributor is available in a version with surge suppression that has an LED indicator and noise-filtration components.

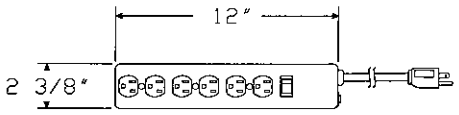
Options
To hold the electrical distributor at work surface height on an Arrio table desk, order the Bracket, Multi-Outlet Electrical Distributor (XR130.), separately.

For use with Action Office products, order the Cable Management Trough, Panel Suspended (AO381.), or the Cable Management Trough, Work Surface Suspended (AO382.), separately.

Limitations
Check the local electrical codes for acceptable applications; some do not permit the use of this electrical distributor.

Electrical Distributor, Multi-Outlet
NP289.

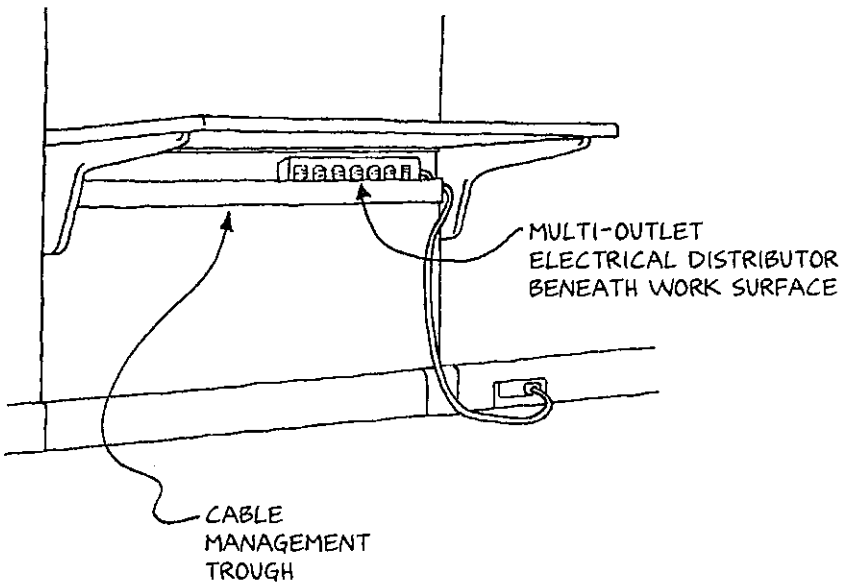
Description
This electrical distributor attaches to an Action Office panel-suspended cable management trough or Ethospace cable management trough or fits in a Newhouse Group cable management channel, an Arrio electrical distributor bracket, or the stretcher on an Arrio work surface. It provides additional receptacles at work surface height and has six standard, three-prong receptacles with a 15-amp circuit breaker. The electrical distributor is UL listed and CSA certified.



Dimensions
Width is 12"; depth is 2 3/8".

Planning Considerations
The distributor is available in a version with surge suppression that has an LED indicator and noise-filtration components.

Placing the multi-outlet electrical distributor at work surface height allows easy access for users; this is especially helpful to workers with reach limitations. Placing the electrical distributor below the work surface makes the receptacles slightly less accessible, but hides them from view.



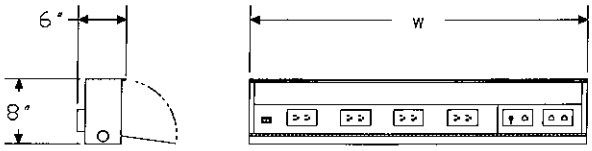
Ethospace work surfaces, Arrio table desks, and Newhouse Group table desks have integral channels that will hold the electrical distributor; they require no additional components. To use the electrical distributor below the work surface height, use an Action Office cable management trough.

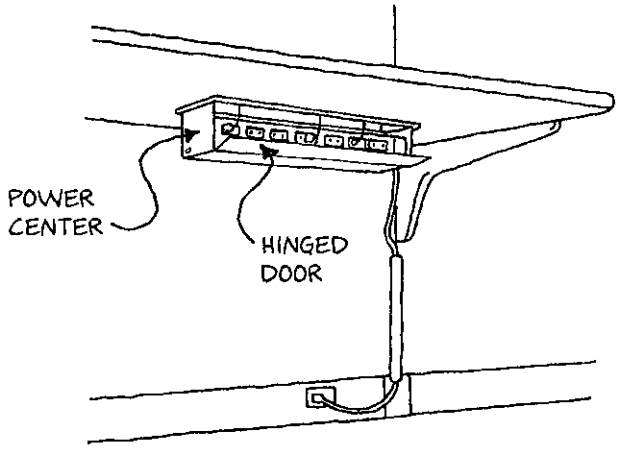
Options
For use with Action Office products, order the Cable Management Trough, Panel Suspended (AO381.), or the Cable Management Trough, Work Surface Suspended (AO382.), separately.

Limitations
This electrical distributor is not permitted under some local codes. Check the local electrical codes for acceptable applications.

Power Center
NP359.

Description
This power center mounts under a work surface with cable ports; it can also be field mounted under an existing Action Office work surface for high-density cable management. The power center has a hinged door for access to duplexes and cables and a 6' power cord that plugs into an Action Office or standard duplex receptacle. Electrical and voice/data cables are separate and exit the raceway from opposite sides. The voice/data locations are designed for Epitome connectors.





The 21"-wide power center cannot mount under a work surface less than 24" wide; the 42"-wide power center cannot mount under a work surface less than 48" wide.

Dimensions
Widths are 21" and 42".

Height is 8".

Depth is 6".

Planning Considerations
The power center is an alternative to a multi-outlet distributor when communication ports are required in addition to 15-amp duplex receptacles.

The various sizes and configurations of power centers offer combinations of up to four 15-amp duplexes and six Epitome communication ports.

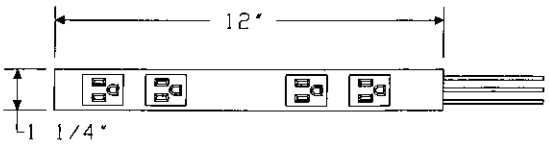
Although its location beneath the work surface makes the receptacles and cable communication modules slightly less accessible, the power center is hidden from view when installed.

Voice/data connections must be field wired.

Faceplates for Epitome cable communication modules are not provided and must be purchased separately from the manufacturer.

Outlet Strip
AO371.

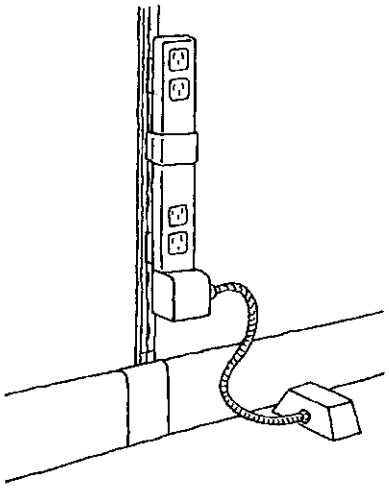
Description
This multi-outlet strip attaches to a panel or wall strip to provide additional outlets at the panel baseline. It has four grounded receptacles and is UL listed and CSA certified.



Dimensions
Width is 1 1/4"; height is 12".

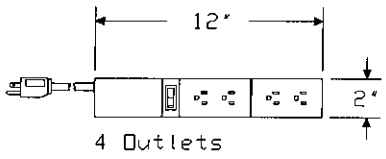
Planning Considerations
A licensed electrician must field wire the outlet strip to meet local electrical codes.

Options
To attach the outlet strip to a panel or wall strip, order the Mounting Kit (AO372.) separately.



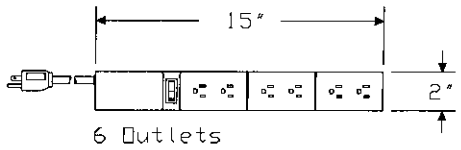
Cable Port Outlet Strip
NP358.

Description
This putty-colored multi-outlet strip mounts under a work surface with cable ports. It provides additional outlets and manages cables beneath the work surface. It has a 6' power cord.



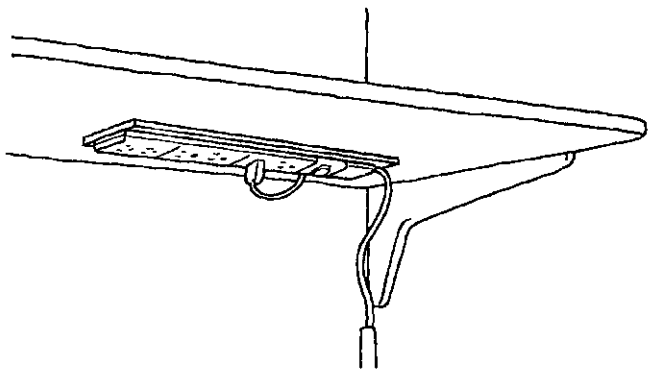
Dimensions
Widths are 12" and 15".

Depth is 2".



Planning Considerations
Specify the four-outlet strip for the 13 1/2"- or 19 1/2"-wide cable port in the work surface; specify the six-outlet strip for the 19 1/2"-wide cable port.

The outlets pop up when the cable port lid is raised, making them accessible from the top of the work surface.



A licensed electrician must field wire the outlet strip to meet local electrical codes.

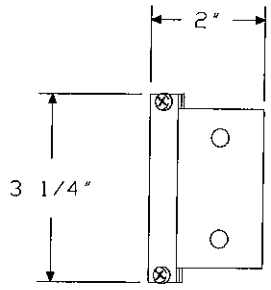
Options
Order the optional Cable Management Trough, Panel Suspended (AO381.), separately.

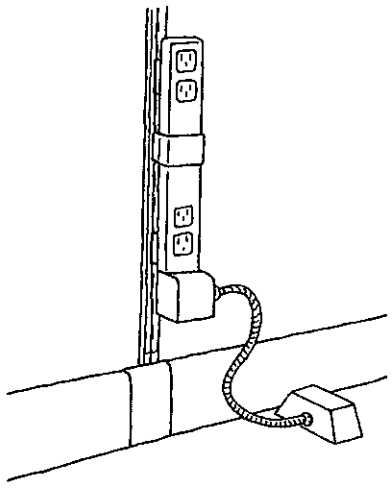
To access the cable port outlet strip from the top of a work surface, order the Cable Port (NP360.) separately.

Mounting Kit
AO372.

Description
This kit attaches an outlet strip to a panel or wall strip.

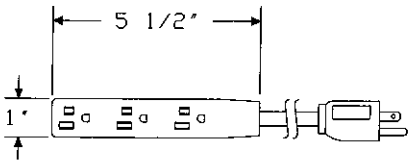
Planning Considerations
This mounting kit attaches to the slots in the panel hanger rails or wall strips.





Extension Cord
AO373.

Description
This black, 9' extension cord has three grounding-type outlets.



Dimensions
Length of the extension cord is 9'.

Width of the outlet block is 5 1/2".

Planning Considerations
The extension cord provides additional length when the equipment plug cannot reach the receptacle.

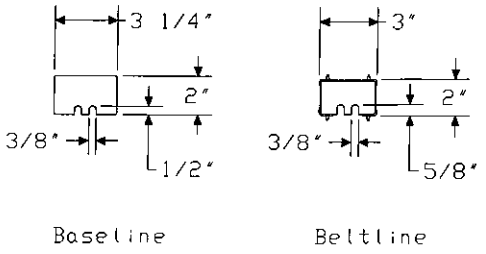
Limitations
An extension cord may not be permitted under some local codes. Check the local codes for acceptable practices.

Faceplate with Cutouts
G1310.

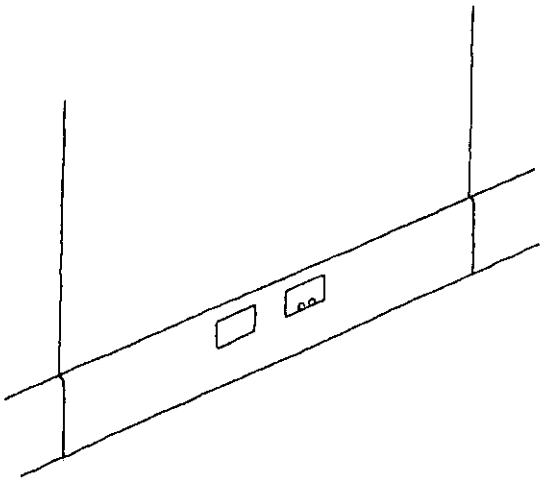
Description
This faceplate allows voice/data cables to exit from receptacle locations. Package contains twelve.

Dimensions
Width is 3 1/4".

Height is 2".



Planning Considerations
This faceplate covers most of a baseline receptacle location while providing exit holes for two voice/data cables. It replaces the solid-face receptacle location cover and is used as an alternative to having cables exit at their normal location at the end of the panel or frame.



Voice and data cables must be able to fit through exit holes that are 1/2" high and 3/8" wide. (Larger cables must exit through the end of the panel or frame.)

Limitations
The beltline faceplate can be used only with Ethospace frames.