

Panduct® PanelMax™ Shielded Wiring Duct and Noise Shield

PanelMax™ Shielded Wiring Duct and Noise Shield route, separate, and shield sensitive wiring from noise emission. This allows pathways to be placed in closer proximity, saving valuable space within industrial control panels. The shielding provides up to 20dB reduction in noise (EMI/RFI), or 90% noise voltage reduction (NVR), which is equivalent to 6 inches of air spacing between sensitive and noise-emitting wiring.* **

Several wire routing and segregation configurations are possible with the innovative Shielded Wiring Duct and Noise Shield, delivering greater design flexibility to satisfy a wide range of applications.

These products are part of the broad range of reliable product systems offered by the Panduit Industrial Automation Solution. These product systems aid in reducing design and assembly time, create valuable panel space savings, and provide easier installation and maintenance.



PanelMax™
Shielded Wiring Duct

PanelMax™
Noise Shield



PanelMax™ Shielded Wiring Duct

Key Features

Benefits

Continuous foil shield* **^‡	Durable metallic foil covers and shields outer duct surfaces providing EMI/RFI noise reduction between sensitive and noisy wiring for up to 20dB reduction in noise, or 90% NVR (equivalent to 6 inches of air spacing)
Slotted sidewalls with horizontal bridge connectors	Provide wire management capability and noise reduction in the full height of the duct; slot size compatible with various wire types and sizes, including UTP Ethernet cabling
High-quality Panduit PVC wiring duct base♦	Fully contains and protects wiring; easy to cut and install; ensures reliable performance and improved aesthetics; used with standard Panduit wiring duct cover; installs with standard fasteners, including Panduit NR1 rivets
Upper and lower score lines	Facilitate duct finger and sidewall section removal to ease installation and wire routing

PanelMax™ Noise Shield

Key Features

Benefits

Metal noise barrier* **^‡	Reduces EMI/RFI noise between sensitive and noisy wiring for up to 20dB reduction in noise, or 90% NVR (equivalent to 6 inches of air spacing); innovative design installs easily within Panduit wiring duct or when mounted separately, delivering greater design flexibility to satisfy a wide range of applications
Bonding clip ^	When installing the shield inside a wiring duct, the bonding clip maintains electrical continuity between the panel and shield for optimal noise mitigation and aesthetics
Segmented design	Speeds installation by allowing section(s) of the shield to be cut and snapped off at intervals to easily size shield to length, with minimal deburring
Vertical wall slots	Allow wires to cross the barrier at 90° when necessary, providing greater design flexibility
Horizontal cable tie slots	Allow wire bundles to be held in place using cable ties to optimize cable management and aesthetics
Zinc-plated steel and durable black powder-coated surfaces	Durable powder-coated vertical surfaces for smooth edges; uncoated, corrosion resistant, zinc-plated surface in shield contact area with sub-panel, ensures continuity for proper bond to ground

*Recommendations for distance separation between noisy and low-noise zones are referenced in IEEE 1100 Emerald Book, *Recommended Practice for Powering and Grounding Electronic Equipment*. Consult the component manufacturer for specific wire segregation distance requirements.

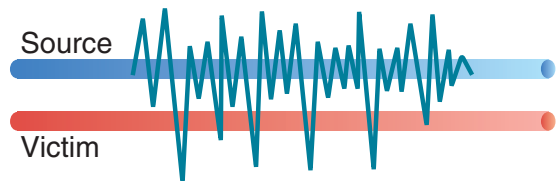
**PanelMax™ Shielded Wiring Duct and Noise Shield deliver approximately 20dB of noise reduction across common industrial noise frequencies at 30mm wire separation with an approximate 1 meter coupling length.

^The shielded wiring duct or noise shield, bonding clip (if used) and enclosure must be electrically bonded to ground for the shield to be effective (see Panduit installation instructions EP001, for shielded wiring duct or RW260, for noise shield).

‡For reference on optimal control panel layouts see the *Panduit Industrial Ethernet Physical Infrastructure Reference Architecture Design Guide*.

♦UL Recognized continuous use temperature: 122°F (50°C)

Noise and Its Effects on Industrial Controls



One of the core issues affecting the performance and reliability of industrial control systems is electrical noise emitted from devices. This electrical noise can create voltage spikes in victim wiring, affecting component performance (as figure at left depicts).

Potential noise emitters/wiring

- Variable frequency and servo motor drives
- Switching power supplies
- Contact switching of coils and solenoid valves



Sensitive devices/wiring

- Communications/network wiring (UTP Ethernet, RS232)
- High-speed counting signals
- Controllers
- Microprocessor based devices



Business Risks

- Productivity loss
- Downtime
- Maintenance/repair costs
- Device replacement costs
- Troubleshooting costs

Proper noise mitigation and panel layout practices help to ensure system productivity, quality, and safety. Panel designers have historically used air spacing between components and wire pathways for noise mitigation, per IEEE recommendations. With Panduit® PanelMax™ Shielded Wiring Duct and Noise Shield, panel designers can provide noise mitigation with reduced air spacing requirements allowing for a space optimized control panel layout.

Multi-Layered Noise Prevention and Mitigation

Panduit recommends following a multi-layered electrical noise prevention and mitigation strategy that also optimizes control panel space utilization. This strategy includes grounding/bonding, segregation, shielding, and filtering practices to provide optimal protection. This product bulletin focuses on noise mitigation via shielded wiring duct and noise shield products. Refer to Panduit's white paper WP-14, Optimizing Control Panel Layouts for Noise Mitigation in Factory Automation Systems, for greater detail on other strategy recommendations.

Considering Shielded Cables vs. Shielded Wiring Duct and Noise Shield

An alternative to shielded wiring duct or noise shield is to consider an increased use of shielded cables, such as shielded twisted pair network cables and shielded control cables. Shielded cables provide superior noise mitigation and noise voltage reduction, but at a typically higher premium and installed cost than unshielded cables. Panduit® PanelMax™ Shielded Wiring Duct and Noise Shield add project value by providing sufficient noise mitigation at a lower premium than a shielded cable solution.

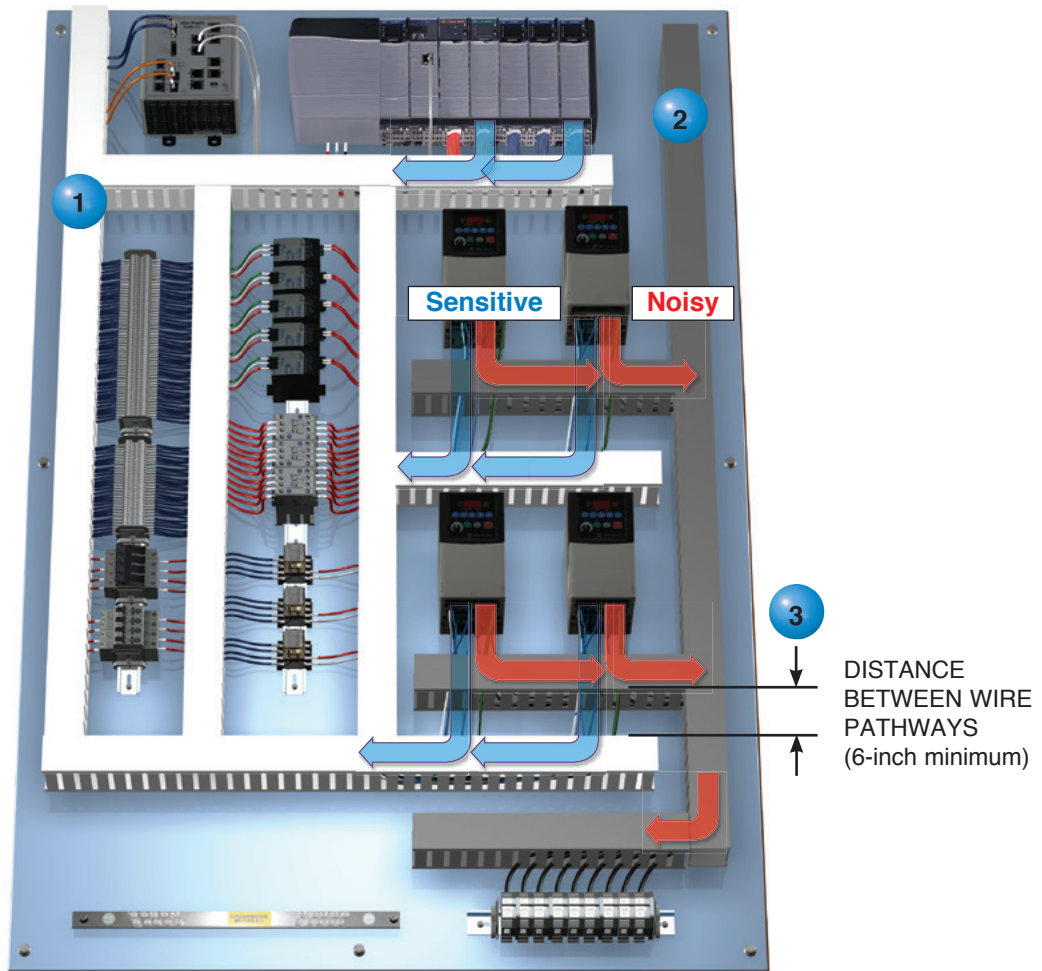
Shielded Wiring Duct and Noise Shield advantages:

- Routing 10 standard unshielded cables in shielded wiring duct has up to a 35% lower purchased cost vs. 10 shielded cables routed in conventional wiring duct
- Shielded wiring duct and noise shield provide an effective noise mitigation solution when a shielded cable option is not available or is difficult to source

Conventional Panel Layout

Motor Control and Networked Programmable Automation Controller (PAC) Panel

A conventional panel layout uses air spacing between pathways and components as a strategy to mitigate noise. Duct color is used to indicate noisy (gray) and clean (white) pathways.



The strategy is to keep sensitive and potentially noisy wiring/cabling separated to mitigate noise:

- 1** Control and potentially sensitive wiring is routed in "clean" pathways (white color).
- 2** Power and potentially noise-emitting wiring is routed in "noisy" pathways (gray color).
- 3** A 6-inch distance is used between parallel noisy and clean wire pathways to mitigate noise coupling.[^]

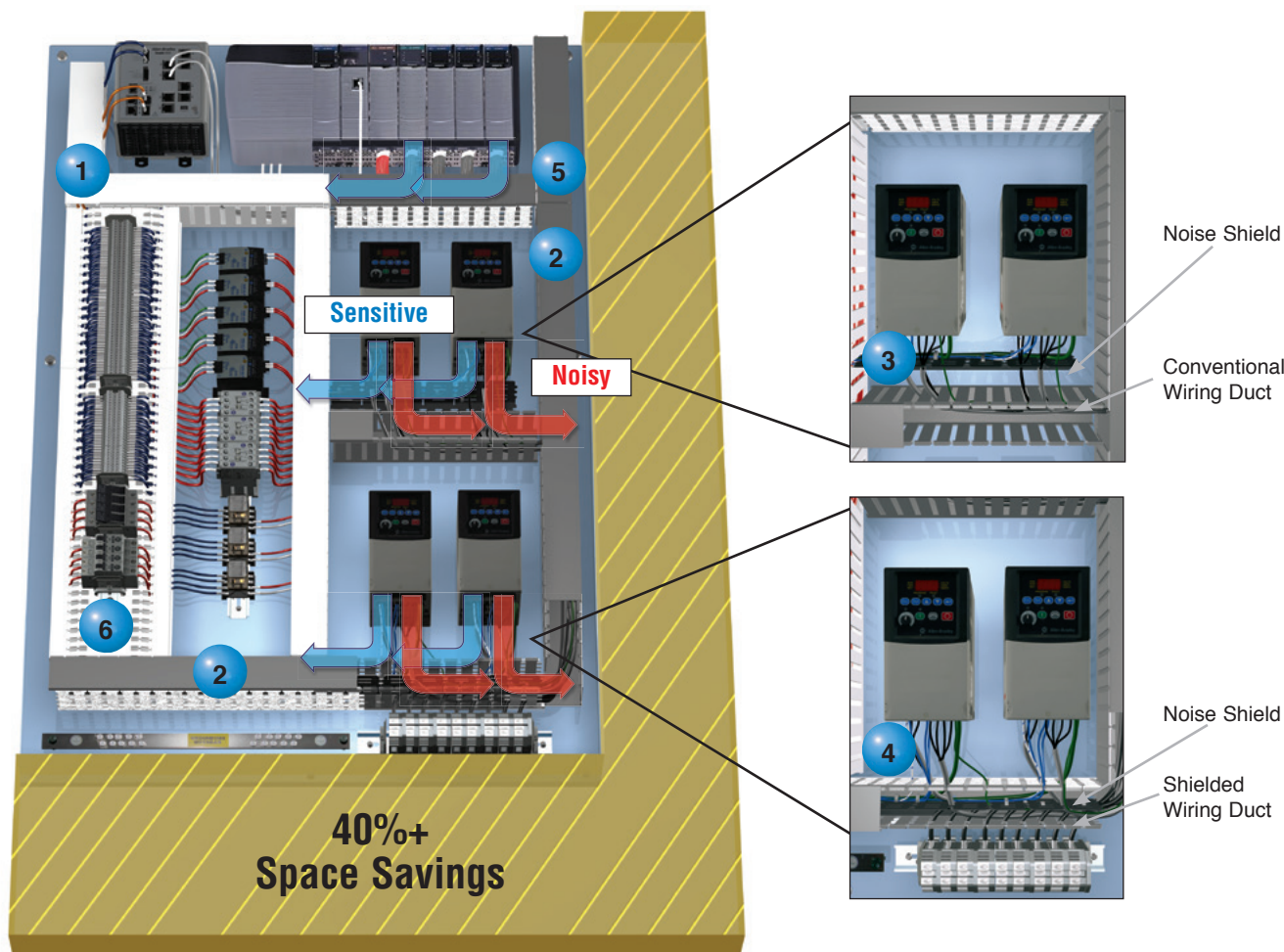
Problems to resolve:

- Difficult to lay out and maintain segregated pathways throughout design
- Distance spacing often requires a larger panel size to implement, significantly increasing panel costs and enclosure footprint requirements
- Distance separation between wire pathways can be compromised due to panel space constraints

[^]As a best wiring practice, where necessary, sensitive and potentially noisy wires should cross only at 90° in order to minimize the coupled length between wires.

Optimized Layout with PanelMax™ Offering

An optimized panel layout uses PanelMax™ Shielded Wiring Duct and Noise Shield to provide noise mitigation with reduced distance spacing required between clean and noisy pathways. PanelMax™ DIN Rail Wiring Duct is also implemented to provide additional panel space savings.



The strategy is to shield, mitigating noise between sensitive and potentially noisy wiring/cabling while reducing panel space:

- 1 Control and potentially sensitive wiring is routed in “clean” pathways (white color).
- 2 Power and potentially noisy wiring is routed in “noisy” pathways or shielded wiring duct (gray color).
- 3 Conventional wiring duct contains motor cabling. Noise shield is mounted separately to shield control and network cabling.
- 4 Optionally, noise shield is mounted inside shielded wiring duct to segregate and shield sensitive cabling from noise. Shielded wiring duct mitigates potential noise emission from cabling inside the duct near clean pathways.
- 5 Shielded wiring duct mitigates potential noise emission from motor drives onto the PAC device and sensitive wiring connections.
- 6 PanelMax™ DIN Rail Wiring Duct is added to the design to provide additional space savings.▼

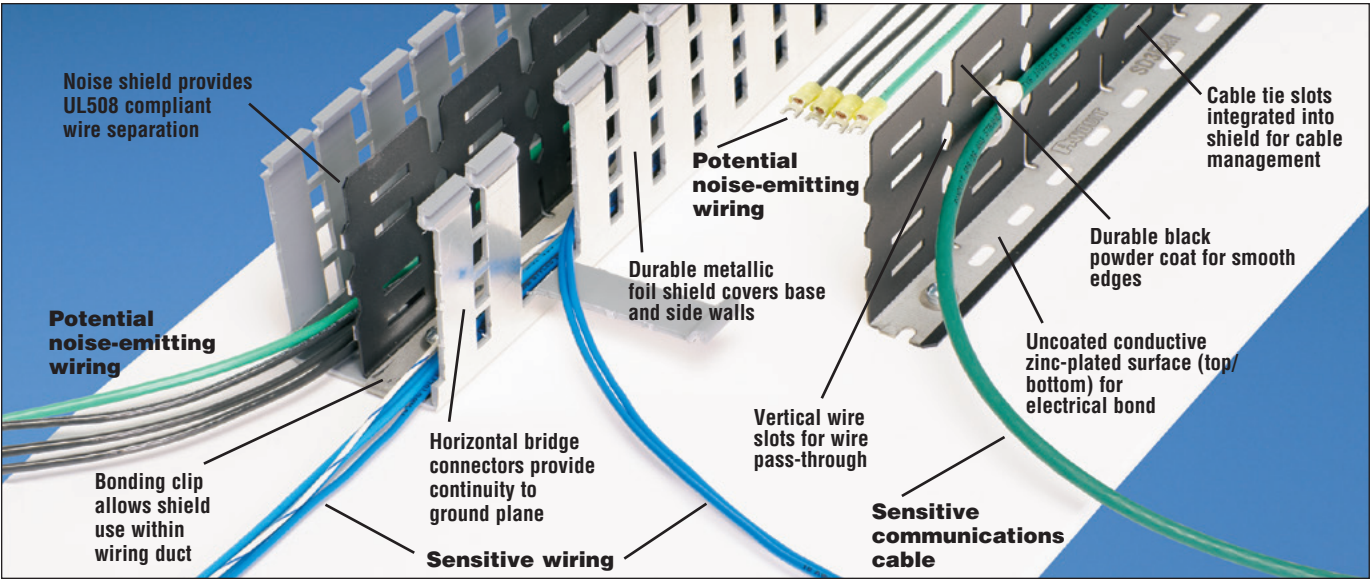
Layout Benefits:

- Robust noise mitigation is achieved
- Shielded wiring duct and noise shield reduce panel height by over 20% and DIN Rail wiring duct reduces panel width by over 20% resulting in significant enclosure footprint reduction
- Net value of space saved in panel/enclosure with cost of PanelMax™ Shielded Wiring Duct and Noise Shield and DIN Rail Wiring Duct is between \$1,500 and \$5,000■

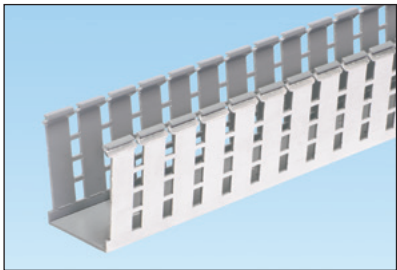
▼ See www.panduit.com for more information on PanelMax™ DIN Rail Wiring Duct (product bulletin WDCB36--SA-ENG).

■ Material cost savings potential depends on enclosure/panel type selected (e.g., standard NEMA12 steel vs. NEMA4X stainless steel enclosures).

Ordering Information



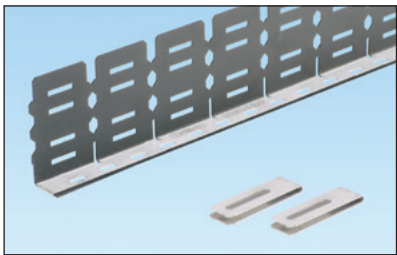
Ordering Information



PanelMax™ Shielded Wiring Duct

Part Number	Part Description	Std. Pkg. Qty.
G2X2LG6EMI	2" x 2" PanelMax™ Shielded Wiring Duct; 6-foot length. Foil metal finish includes anti-oxidizing paste. Cover sold separately.	12
G2X3LG6EMI	2" x 3" PanelMax™ Shielded Wiring Duct; 6-foot length. Foil metal finish includes anti-oxidizing paste. Cover sold separately.	12
G2X4LG6EMI	2" x 4" PanelMax™ Shielded Wiring Duct; 6-foot length. Foil metal finish includes anti-oxidizing paste. Cover sold separately.	12

Use C2LG6 or C2WH6 cover with shielded wiring duct. Standard package quantity in feet.

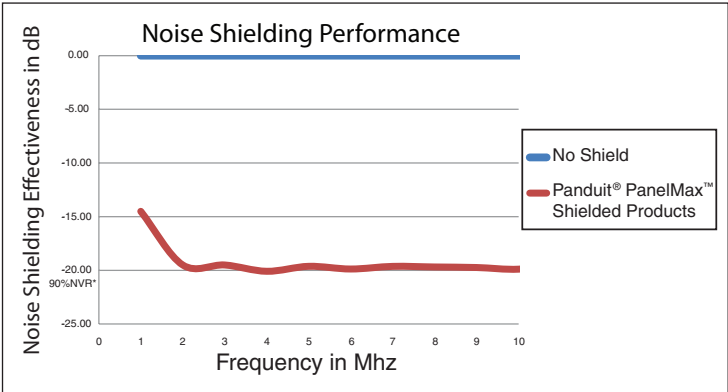


PanelMax™ Noise Shield and Bonding Clips

Part Number	Part Description	Std. Pkg. Qty.
SD2EMI	EMI noise shield kit for 2" height Panduit wiring duct; two 3-foot sections, four bonding clips, and anti-oxidizing paste.	1
SD3EMI	EMI noise shield kit for 3" height Panduit wiring duct; two 3-foot sections, four bonding clips, and anti-oxidizing paste.	1
SD4EMI	EMI noise shield kit for 4" height Panduit wiring duct; two 3-foot sections, four bonding clips, and anti-oxidizing paste.	1
SDCLIP	Noise shield replacement bonding clips – 2 clips.	1

Standard package quantity in kits.

Performance Characteristics



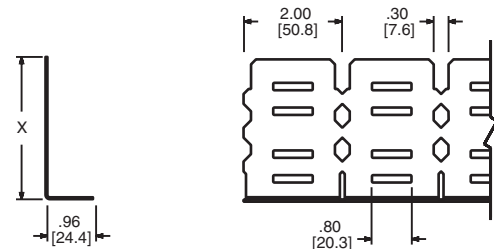
Relative noise reduction in decibels over frequency range of Panduit® PanelMax™ Shielded Wiring Duct and Noise Shield

PanelMax™ Shielded Wiring Duct and Noise Shield deliver approximately 20dB of noise reduction across common industrial noise frequencies at 30mm wire separation with an approximate 1-meter coupling length.

*NVR (Noise Voltage Reduction percentage).

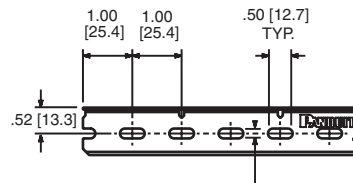
Technical Information

PanelMax™ Noise Shield

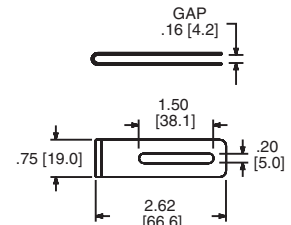


Part No.	X — Inches (mm)
SD2EMI	1.82 (46.1)
SD3EMI	2.88 (73.2)
SD4EMI	3.86 (98.2)

Sidewall: SD3EMI shown.
SD2EMI sidewall features one pair of cable tie slots per section.

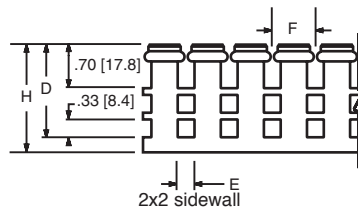
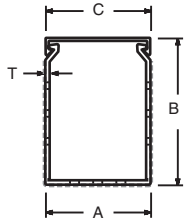


Bottom view.

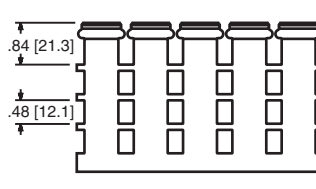


Bonding clip (for use with wiring duct).

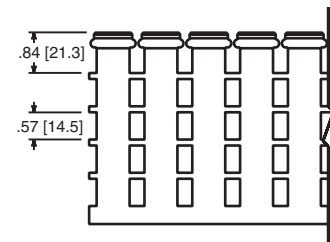
PanelMax™ Shielded Wiring Duct



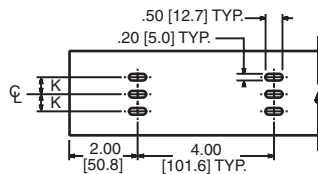
2x2 sidewall



2x3 sidewall



2x4 sidewall



Part Number	Dimensions — Inches (mm)								
	A	B	C	D	E	F	H	K	T
G2X2LG6EMI	2.25 (57.2)	2.12 (53.8)	2.25 (57.2)	1.61 (41.0)	0.31 (7.9)	0.80 (20.3)	2.00 (50.8)	0.50 (12.7)	0.08 (2.0)
G2X3LG6EMI	2.25 (57.2)	3.12 (79.2)	2.25 (57.2)	2.64 (67.0)	0.31 (7.9)	1.00 (25.4)	3.00 (76.2)	0.50 (12.7)	0.10 (2.4)
G2X4LG6EMI	2.25 (57.2)	4.10 (104.1)	2.25 (57.2)	3.62 (91.9)	0.31 (7.9)	1.00 (25.4)	4.00 (101.6)	0.50 (12.7)	0.11 (2.7)

PanelMax™ Shielded Wiring Duct Wire Fill

Part Number	Nominal Area in ²	Electrical															Communication			
		8 AWG	10 AWG	12 AWG		14 AWG		16 AWG		18 AWG		22 AWG	23 AWG	23/24 AWG	24 AWG	Fiber Cable				
		0.216 THHN	0.164 THHN	0.130 THHN	0.141 MTW	0.152 MTW	0.111 THHN	0.124 MTW	0.133 MTW	0.096 TFFN	0.111 MTW	0.118 MTW	0.084 TFFN	0.100 MTW	0.106 MTW	0.085 Cat 6A	0.330 Cat 6	0.250 Cat 5e	0.118 3.0 mm	
G2X2LG6EMI	4.000	48	84	135	114	98	185	148	129	248	185	164	323	228	203	316	20	36	63	163
G2X3LG6EMI	6.000	73	127	202	172	148	278	222	193	372	278	246	485	342	305	474	31	54	94	245
G2X4LG6EMI	8.000	97	169	270	229	197	371	297	258	496	371	328	647	457	406	632	41	73	126	327

Table shows maximum wire fill based on 50% of duct internal cross sectional area. Formula = Nominal Area / 1.75xD². All dimensions represent typical outer cable diameter in inches.

Related products



NR1 Nylon Rivet
For use with TNR tool



TNR Nylon Rivet Installation Tool
Hand-held tool for easy rivet installation



DNT-100 Notching Tool
Notches duct sidewalls to bottom scoreline for tees and corners



DCT Tool
Provides a smooth burr-free cut on both wiring duct and cover



CWST Tool
Snipping tool cuts conductors flush for improved performance

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