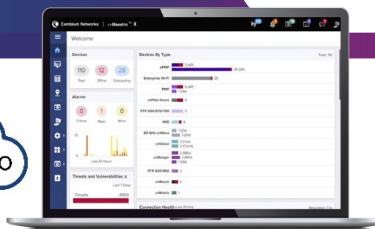


cnMatrix EX2000 Series Switches

EX2000 Series Quick Look

- Zero-touch deployments
- Policy-based automation
- Auto-device profiling and segmentation
- Non-blocking, line-rate architecture with fully featured L2/L3 switching



Cloud-Managed, Secure, Enterprise-Grade Switching

Cambium Networks' next-generation switching platform offers a cloud-managed, high-performance, feature-rich, enterprise-grade ethernet switching solution.

The cnMatrix™ platform of switches provides:

- Easy and simple, free cloud (or on-premise) management with cnMaestro™ Network Management.
- Zero-touch deployment of switches makes installation easy.
- Policy-based automation eliminates manual and time consuming configuration, during adds, moves, and changes of network devices.
- Enhanced security with automated device profiling and segmentation.
- Unified wired-wireless access solution.

The cnMatrix series of fully managed switches delivers full Layer 2 and Layer 3 capabilities with enhanced access security. Depending on the model, the cnMatrix EX2000 Series offers flexibility with SFP+ (10 Gbps) or SFP (1 Gbps) uplink ports. These switches come with a 5-year limited lifetime warranty.



cnMatrix EX2000 Series Switches

Specifications								
	EX2052	EX2052-P	EX2052R-P	EX2016M-P	EX2028-P	EX2028	EX2010-P	EX2010
Throughput	176 Gbps	176 Gbps	176 Gbps	86 Gbps	128 Gbps	128 Gbps	20 Gbps	20 Gbps
Non-Blocking Throughput	✓	✓	✓	✓	✓	✓	✓	✓
Forwarding Rate in Mpps (64 Byte Packets)	120	120	120	120	120	120	120	120
Packet Buffer	1.5 MB	1.5 MB	1.5 MB	1.5 MB	1.5 MB	1.5 MB	1.5 MB	1.5 MB
10/100/1000 Ports	48	48	48	8	24	24	8	8
2.5G Ports (60W)	n/a	n/a	n/a	6	n/a	n/a	n/a	n/a
Energy-Efficient Ethernet	✓	✓	✓	✓	✓	✓	✓	✓
Uplink Ports	4 SFP+	4 SFP+	4 SFP+	2 SFP+	4 SFP+	4 SFP+	2 SFP	2 SFP
PoE+ Enabled Ports 802.3af/at	n/a	48	48	8	24	n/a	8	n/a
PoE+ Enabled Ports 802.3af/at/bt (60W)	0	0	0	6	0	0	0	0
Serial Console	✓	✓	✓	✓	✓	✓	✓	✓
USB	✓	✓	✓	✓	✓	✓	✓	✓
Out-of-Band Management Port	✓	✓	✓	✓	✓	✓	✓	✓
Rack Mount Kit	✓	✓	✓	✓	✓	✓	Optional	Optional
Internal Fans	1	3	2	2	2	Fanless	Fanless	Fanless
Reset Button	✓	✓	✓	✓	✓	✓	✓	✓
MAC Address Table Size	16K	16K	16K	16K	16K	16K	16K	16K
Flash Storage	128 MB	128 MB	128 MB	128 MB	128 MB	128 MB	128 MB	128 MB
DRAM	512 MB	512 MB	512 MB	512 MB	512 MB	512 MB	512 MB	512 MB
VLANs (simultaneous)	4K	4K	4K	4K	4K	4K	4K	4K
QinQ	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LACP/Trunking	8 LAGs/8 ports per LAG							
QoS Priority Queues	8	8	8	8	8	8	8	8
PVRST	64	64	64	64	64	64	64	64
Ingress/Egress ACL	145	145	145	145	145	145	145	145
Static ARP Entries	512	512	512	512	512	512	512	512
ARP Entries	1000	1000	1000	1000	1000	1000	1000	1000
Static Routes	64	64	64	64	64	64	64	64
Dynamic Routing	512	512	512	512	512	512	512	512
IGMP Multicast Groups	512	512	512	512	512	512	512	512
L3 Interfaces	64	64	64	64	64	64	64	64
Policy-Based Automation (PBA)	✓	✓	✓	✓	✓	✓	✓	✓

cnMatrix EX2000 Series Switches

Specifications – All Models

Quality of Service	ACL mapping/marking of ToS/DSCP (COS)	Layer 2 Feature Set	802.1d, RSTP, 802.1s - MSTP, PVRST
	ACL mapping marking of 802.1p		ERPSv1–Ethernet Ring Protection Switching
	ACL mapping to priority queue		VLAN, port, protocol, 802.1q
	DiffServ support		QinQ
	Honoring DSCP and 802.1p (CoS)		Auto MDI/MDIX
	Traffic shaping/metering		BPDU guard, root guard, loop guard
	Priority queue management using Weighted Round Robin (WRR), Strict Priority (SP) and a combination of WRR and SP		BPDU filtering
			IGMP snooping v1/v2/v3*, fast leave
Traffic Management	ACL-based inbound rate-limiting policies		IGMP proxy
	Broadcast, multicast, and unknown unicast rate limiting (storm control)		LLDP/LLDP MED
	Inbound rate limiting per port		Static MAC
	Outbound rate limiting per port/queue		Flow control per port
Security	802.1x authentication		Port mirroring/SPAN: Port based, ACL based, VLAN based
	MAC authentication/MAB		Port isolation/private VLAN edge
	Guest VLAN/failover VLAN authorization		Link aggregation groups (static/LACP)
	Local/radius authentication/authorization (dynamic VLAN assignment)		Jumbo frame (9K)
	Radius/Tacacs/Tacacs+		DoS protection
	Secure shell		Ping/Trace Route/ICMPv6
	Secure copy (SCP)		
	Local username/password		
	Port security		
	DHCP snooping		
	Dynamic ARP inspection		
Security (ACL) Permit/deny actions for inbound IP and layer 2 traffic classification based on:	Source/destination IP address	Layer 3 Feature Set	Inter-VLAN routing
	TCP/UDP source/destination port		Static ARPs
	IP protocol type		Static routes
	Type of Service (ToS) or differentiated services (DSCP) field		DHCP relay w/multiple helpers per VLAN
	Source/destination MAC address		Dynamic routing – RIPv1/v2
	EtherType		Dynamic routing – OSPFv2
	IEEE 802.1p user priority		Route redistribution
	VLAN ID		
	RFC 1858—Security considerations for IP fragment filtering		
Management	cnMaestro	Out-of-band Ethernet management	TFTP/SFTP
	Industry standard Command Line Interface (CLI)	SSH/SSH v2	Telnet client/server
	DHCP client	SNMP v1/v2/v3	IPv6 management
	Embedded web management (HTTP/HTTPS)	Simple Network Time Protocol (SNTP)	Password management
	DHCP server	Local/remote system logging (syslog client)	
	USB file management and storage	Policy-based automation (PBA)	

* Feature to be included in a future release.

cnMatrix EX2000 Series Switches

Hardware Specifications

	EX2052	EX2052-P	EX2052R-P	EX2016M-P	EX2028-P	EX2028	EX2010-P	EX2010
Power Supply	100–240 VAC	100–240 VAC	CRPS dependent	100–240 VAC	100–240 VAC	100–240 VAC	100–240 VAC	100–240 VAC
Max Switch Power (with Traffic)	38.88W	39.24W	46.98W	26.76W	25.10W	19.50W	10.54W	9.88W
MTBF (Hours)	393,648	238,063	202,977	385,242	285,350	432,283	338,917	806,354
Flash Storage	128 MB	128 MB	128 MB	128 MB	128 MB	128 MB	128 MB	128 MB
DRAM	512 MB	512 MB	512 MB	512 MB	512 MB	512 MB	512 MB	512 MB
Weight	3.6 kg (7.93 lb)	5.4 kg (11.90 lb)	4.3 kg (9.48 lb) or 5.2 kg (11.46 lb)	3.6 kg (7.93 lb)	3.96 kg (8.75 lb)	2.77 kg (6.1 lb)	1.99 kg (4.375 lb)	1.6 kg (3.5375 lb)
Dimensions	44 x 4.4 x 25 cm (17.3 x 1.75 x 9.85 in)	44 x 4.4 x 35 cm (17.3 x 1.75 x 13.78 in)	44 x 4.4 x 35 cm (17.3 x 1.75 x 13.78 in)	44 x 4.4 x 25 cm (17.3 x 1.75 x 9.85 in)	44 x 4.4 x 25 cm (17.3 x 1.75 x 9.85 in)	44 x 4.4 x 20.9 cm (17.3 x 1.75 x 8.22 in)	21 x 4.4 x 25 cm (8.26 x 1.75 x 9.85 in)	21 x 4.4 x 25 cm (8.26 x 1.75 x 9.85 in)
CPU Speed	800 MHz	800 MHz	800 MHz	800 MHz	800 MHz	800 MHz	800 MHz	800 MHz
LEDs per Port	Link/Activity	Link/Activity, PoE	Link/Activity, PoE	Link/Activity, PoE	Link/Activity, PoE	Link/Activity	Link/Activity, PoE	Link/Activity
PoE+ Power Budget	n/a	400W	CRPS dependent	240W	400W	n/a	100W	n/a
PoE + Voltage	n/a	54V	54V	5V	54V	n/a	54V	n/a
PoE Max Power per Port	n/a	30W	30W	30W, 60W	30W	n/a	30W	n/a
Rack Mountable	Yes 1U	Yes 1U	Yes 1U	Yes 1U	Yes 1U	Yes 1U	Yes 1U	Yes 1U
Temperature Ranges	0° to 50°C (32° to 122°F)	0° to 50°C (32° to 122°F)	0° to 50°C (32° to 122°F)	0° to 50°C (32° to 122°F)	0° to 50°C (32° to 122°F)	0° to 50°C (32° to 122°F)	0° to 50°C (32° to 122°F)	0° to 50°C (32° to 122°F)
Operating Humidity	55° at 95% RH	55° at 95% RH	55° at 95% RH	55° at 95% RH	55° at 95% RH	55° at 95% RH	55° at 95% RH	55° at 95% RH
Storage Temperature	-40° to 70°C (-40° to 158°F)	-40° to 70°C (-40° to 158°F)	-40° to 70°C (-40° to 158°F)	-40° to 70°C (-40° to 158°F)	-40° to 70°C (-40° to 158°F)	-40° to 70°C (-40° to 158°F)	-40° to 70°C (-40° to 158°F)	-40° to 70°C (-40° to 158°F)

Acoustic Noise dBA per Switch (Ambient Temperature)

EX2052	40.9 dB - < 33°C, 44.2 dB - 30°C-40°C, 47.3 dB - > 43°C
EX2052-P	48.5 dB - < 33°C, 51.3 dB - 30°C-40°C, 54.0 dB - > 43°C
EX2052R-P	1200W CRPS: 74.5 dB - < 33°C, 74.3 dB - 30°C-40°C, 74.3 dB - > 43°C, 930W CRPS: 70.8 dB - < 33°C, 70.7 dB - 30°C-40°C, 70.7 dB - > 43°C, 600W CRPS: 67.2 dB - < 33°C, 67.3 dB - 30°C-40°C, 67.5 dB - > 43°C
EX2016M-P	44.4 dB - < 33°C, 46.9 dB - 30°C-40°C, 49.3 dB - > 43°C
EX2028-P	40 dB - < 33°C, 44.3 dB - 30°C-40°C, 52 dB - > 43°C
EX2028	Fanless
EX2010-P	Fanless
EX2010	Fanless

cnMatrix EX2000 Series Switches

IEEE Standards

Core Switching Features

IEEE 802.1ab—Link Layer Discovery Protocol (LLDP)

IEEE 802.1D—Spanning tree compatibility

IEEE 802.1p—Ethernet priority with user provisioning and mapping

IEEE 802.1s—Multiple spanning tree compatibility

IEEE 802.1Q—Virtual LANs with port-based VLANs

IEEE 802.1X—Port-based authentication

802.3az—Energy-efficient Ethernet

Advanced Layer 2 Features

Authentication, Authorization, and Accounting* (AAA)

IEEE 802.1ad (QinQ)

Broadcast/Multicast/Unknown unicast storm recovery

DHCP Snooping

IGMP Snooping Querier

Independent VLAN Learning (IVL) support

Jumbo Ethernet frame support

Port MAC locking

Port mirroring

Protected ports

Static MAC filtering

VLAN Support

IEEE 802.1W—Rapid spanning tree compatibility

IEEE 802.3—10BASE-T

IEEE 802.3u—100BASE-T

IEEE 802.3ab—1000BASE-T

IEEE 802.3ac—VLAN tagging

IEEE 802.3ad—Link aggregation

IEEE 802.3x —Flow control

Bridged Local Area Networks - Amendment 07: Multiple Registration Protocol

Layer 3 Features

Inter-VLAN Routing

Static ARP

Static Routes

RFC 2131 – DHCP Relay

RFC 2328 – OSPF Version 2

RFC 2453 – RIP Version 2

IEEE 802.1Q-2003

RFC 4541—Considerations for Internet, Group Management Protocol (IGMP), Snooping switches

ANSI/TIA-1057—LLDP-media endpoint discovery (MED)

*Feature to be included in a future release.

cnMatrix EX2000 Series Switches

System Facilities

Event and error logging facility	RFC 896—Congestion control in IP/TCP networks	RFC 2132—DHCP options and BOOTP vendor extensions
Run-time and configuration download capability	RFC 951—BOOTP	RFC 2819—Remote Network Monitoring Management Information Base
PING utility	RFC 1034—Domain names - concepts and facilities	RFC 2865—RADIUS client
FTP Transfers via IPv4/IPv6	RFC 1035—Domain names - implementation and specification	RFC 2869—RADIUS Extensions
RFC 768—UDP	RFC 1321—Message digest algorithm	RFC 3579—RADIUS support for EAP
RFC 783—TFTP	RFC 1534—Interoperability between BOOTP and DHCP	RFC 3580—IEEE 802.1X RADIUS usage guidelines
RFC 791—IP	RFC 2021—Remote network monitoring management information base version 2	RFC 3164—BSD syslog protocol
RFC 792—ICMP	RFC 2030—Simple Network Time Protocol (SNTP)	RFC 3580—802.1X RADIUS Usage Guidelines
RFC 793—TCP		
RFC 826—ARP		
RFC 894—Transmission of IP datagrams over Ethernet networks		

Management

SNMP v1, v2, and v3	RFC 4251—SSH protocol architecture	RFC 2818—HTTP over TLS
SSH 1.5 and 2.0	RFC 4716—SECSH public key file format	RFC 3268—AES cipher suites for transport layer security
RFC 4252—SSH authentication protocol	RFC 4419—Diffie-Hellman group exchange for SSH transport layer protocol	Telnet
RFC 4253—SSH transport layer protocol	RFC 2246—TLS protocol, version 1.0	Web GUI
RFC 4254—SSH connection protocol		

SNMP MIBs

Enterprise MIBs for Full Configuration Support of Switching Features	RFC 1213—MIB II	RFC 2618—RADIUS authentication client MIB	RFC 3273—RMON groups 1, 2, and 3
	RFC 1493—Bridge MIB	RFC 2674—VLAN MIB	RFC 3291—Textual conventions for internet network addresses
	RFC 1612—DNS resolver MIB extensions	RFC 2737—Entity MIB version 2*	RFC 3434—RMON Groups 1, 2, and 3
	RFC 1643—Definitions of managed objects for Ethernet-like interface types	RFC 2819—RMON groups 1, 2, 3, and 9	RFC 4022—TCP-MIB
	RFC 2233—Interfaces group MIB using SMI v2	RFC 2863—IF-MIB	RFC 4113—UDP-MIB
	RFC 2613—SMON MIB	RFC 2925—Definitions of managed objects for remote ping, traceroute, and lookup operations	
Quality of Service MIBs	MIBs for full configuration support of DiffServ, ACL, and Cos functionality		
	RFC 3289—Management information base for DiffServ architecture (read-only)		

* Feature to be included in a future release.

cnMatrix EX2000 Series Switches

Quality of Service

Classify Traffic Based on Same
Criteria as ACLs and Optionally

Mark the IP DSCP or precedence header fields

Police the flow to a specific rate with two- color aware support

RFC 2474—Definition of the differentiated services field (DS field) in the IPv4 and IPv6 headers

RFC 2475—An architecture for differentiated services

RFC 2597—Assured forwarding per-hop behavior



EX2010



EX2010-P



EX2016M-P



EX2028



EX2028-P



EX2052



EX2052-P



EX2052R-P / CRPS

cnMatrix EX2000 Series Switches

Ordering Information		
Type	Part #	Description
Switch	MXEX2052GxxA00	Intelligent Ethernet Switch, 48 x 1 Gbps and 4 SFP+ - no power cord
Switch	MXEX2052GxPA00	Intelligent Ethernet PoE Switch, 48 x 1 Gbps and 4 SFP+ Fixed 540 - no power cord
Switch	MXEX2052GxPA10	Intelligent Ethernet PoE Switch, 48 x 1 Gbps and 4 SFP+, Removable Power Supply (not included) - no power cord
Switch	MXEX2016MxPA00	Intelligent Ethernet PoE Switch, 8 x 1 Gbps + 6 x 2.5 Gbps + 2 x SFP+, no power cord
Switch	MX-EX2028Px-A-0	Intelligent Ethernet PoE Switch, 24 x 1 Gbps and 4 SFP+ fiber ports - no power cord
Switch	MX-EX2028xx-A-0	Intelligent Ethernet Switch, 24 x 1 Gbps and 4 SFP+ fiber ports - no power cord
Switch	MX-EX2010Px-A-0	Intelligent Ethernet PoE Switch, 8 x 1 Gbps and 2 SFP fiber ports - no power cord
Switch	MX-EX2010xx-A-0	Intelligent Ethernet Switch, 8 x 1 Gbps and 2 SFP fiber ports - no power cord
CRPS	MXCRPSAC600A0	600W total Power, no power cord
CRPS	MXCRPSAC930A0	930W total Power, no power cord
CRPS	MXCRPSAC1200A0	1200W total Power, no power cord
CRPS	MXCRPSDC600A0	600W total Power, 36v–72v, includes 3m cable connector
CRPS	MXCRPSDC930A0	930W total Power, 36v–72v, includes 3m cable connector
CRPS	MXCRPSDC1200A0	1200W total Power, 36v–72v, includes 3m cable connector
Power Cord	N000900L092A	AC line cord, US Type B, 15A, 1.2 m C13 connector
Rack Mount	MX-EXTXHALFA-0	Half-width switch rack mount kit
Rack Mount	MX-EXTXFULLA-1	Full-width switch rack mount kit
Transceiver	SFP-10G-SR	10G SFP+ MMF SR Transceiver, 850 nm. -40°C to 85°C (-40°F to 185°F)
Transceiver	SFP-1G-SX	1G SFP MMF SX Transceiver, 850 nm. -40°C to 85°C (-40°F to 185°F)
Transceiver	SFP-10G-LR	10G SFP+ SMF LR Transceiver, 1310 nm. -40°C to 85°C (-40°F to 185°F)
Transceiver	SFP-1G-LX	1G SFP SMF LX Transceiver, 1310 nm. -40°C to 85°C (-40°F to 185°F)
Transceiver	SFP-1G-Copper	1000Base-T (RJ45) SFP Transceiver. -40°C to 85°C (-40°F to 185°F)
Transceiver	SFP-10G-Copper	10G Base-T (RJ45) SFP Transceiver. 0°C to 70°C (-40°F to 185°F)
Cambium Care Advanced	CCADV-SUP-xxx	Cambium Care Advanced, 1, 3 or 5-year support for one cnMatrix switch. 24x7 TAC support, SW updates, and NBDS advance replacement for HW
Cambium Care Pro	CCPRO-SUP-xxx	Cambium Care Pro, 1, 3 or 5-year support for one cnMatrix switch. 24x7 TAC support and SW updates

ABOUT CAMBIUM NETWORKS

Cambium Networks enables service providers, enterprises, industrial organizations, and governments to deliver exceptional digital experiences and device connectivity with compelling economics. Our ONE Network platform simplifies management of Cambium Networks' wired and wireless broadband and network edge technologies. Our customers can focus more resources on managing their business rather than the network. We make connectivity that just works.

cambiumnetworks.com

04302025

VHF Omnidirectional Dipole Arrays

136-174 MHz

Binary Array Series



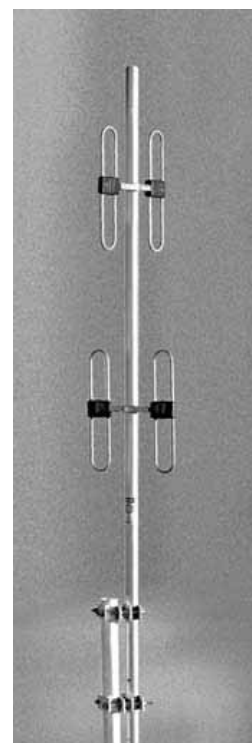
This high performance VHF dipole omnidirectional array is for use in highly populated radio sites requiring long haul omnidirectional coverage. The array feature high gain, low noise performance and enhanced null fill coverage with omnidirectional coverage characteristics.

Each of the dipoles are fed via an internal phasing harness in stable, PTFE based double-screened coaxial cable with PE jacket for optimum weatherproofing. These omnidirectional arrays incorporate extensive side lobe suppression and null fill, and the binary phasing arrangement ensures consistent omnidirectional coverage and vertical pattern control.

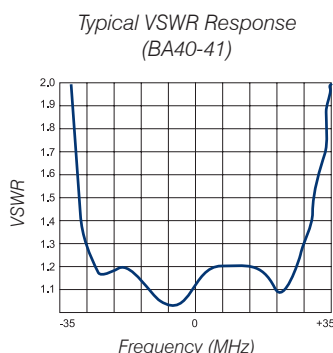
With all welded construction and superior internal harness construction, these antennas provide not only excellent pattern characteristics but also defined, high levels of intermodulation and noise suppression. The entire array rests at ground potential and offers the ultimate in lightning resistant antennas.

Features:

- High gain omnidirectional patterns
- Operate over entire 136-174 MHz VHF band without tuning or adjustment
- Inverted mounting version available
- Industry leading PIM ratings (-150dBc) providing low IM and low noise characteristics for optimum performance
- BA80-41 may be operational as 2 x 3dBd arrays by removing external cables harness (BA4040-41)
- Hermetically sealed internal phasing harness

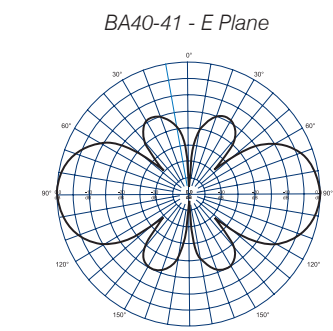


Electrical Specifications



Model Number	BA40-41-P	BA80-41-P	BA4040-41-P
Nominal Gain dBi (dBd)	5 (3)	8 (6)	2 x 5 (3)
Frequency MHz	136 - 174		
Tuned Bandwidth	Entire Band		
VSWR (Return Loss)	< 1.5 :1 (14dB)		
Nominal Impedance Ω	50		
Downtilt	Not offered	0° Std, 3°, 5°, 8°	Not offered
Vertical Beamwidth°	35	18	35
Horizontal Beamwidth°	Omni +/-0.5dB		
Input Power W	750		
Passive IM 3rd order dBc	-150		

Mechanical Specifications



Model Number		BA40-41-P	BA80-41-P	BA4040-41-P
Construction		All welded aluminium with alodined finish. See note (2)		
Length <i>m (inches)</i>		3.5 (138)	6.3 (248)	
Weight <i>kg (lbs)</i>		14.5 (32)	31 (68)	
Termination		4.3-10female with 0.5m (20") RG142 cable tail.		
Mounting Area		750mm x 63mm diam. (20" x 2.5")	750mm x 76mm diam. (20" x 3.0")	
Suggested Clamps		2 x UC1	3 x UC114	
Projected Area <i>cm²</i> (<i>ft²</i>)	No Ice	4164 (4.5)	8294 (8.9)	
	With Ice	7117 (7.7)	13325 (14.3)	
Wind Load @160km/h <i>N (100mph lbs)</i>		494 (111)	983 (221)	
Wind Gust Rating <i>km/h (mph)</i>		240 (150)	184 (114)	
Torque @160km/h <i>Nm (100mph ft-lbs)</i>		617 (455)	2605 (1921)	

(1) Factory pre-set downtilt of 3° may be specified on BA80 series antennas using model no. trailer -T3

(2) BA40 series can be optionally supplied in all welded 316 grade stainless steel. Dimensions vary slightly



ASTRO[®] G-SERIES SITE EQUIPMENT

DATASHEET | ASTRO G-SERIES SITE EQUIPMENT



MOTOROLA SOLUTIONS



COMMON PLATFORM

The ASTRO® portfolio of RF stations, receivers, site controllers and comparators make up the building blocks for Project 25 (P25) two-way radio communication systems from Motorola Solutions. ASTRO site equipment is built with flexibility, resilience and service in mind.



FLEXIBLE DESIGN. SOFTWARE-CONFIGURABLE.

Because it is defined and configured through software, the common platform has the flexibility to support different modes of operations based on individual site requirements. Simple software downloads provide cyber security patches, new features and technology migrations to carry your needs into the future.



ALWAYS AVAILABLE. RESILIENT TO DISRUPTION.

Built to last, ASTRO sites continue to provide wide-area communication regardless of the conditions. From technology that delivers superior coverage to site designs with no single point of failure (resulting in no more than 1 channel removed from service), ASTRO sites provide best-in-class performance.



SERVICE MADE EASY.

ASTRO sites are built to ease service and maintenance with front access modules, cable connections and LED indicators. Hot-swap modules ensure channels are back on the air with minimal downtime. Remote software upgrades with rolling activation makes it easy to stay up to date with minimal disruption.

TOPOLOGIES

Whether analog, digital, conventional or trunked, ASTRO sites support various modes of operation and can be software-configured based on need.

TRUNKING

ASTRO sites support P25 FDMA and TDMA trunking operations ranging from single site to large regional systems. The sites support seamless interoperability with the ability to dynamically switch between FDMA and TDMA without any user intervention or awareness.

CONVENTIONAL

The equipment can be configured to support analog conventional or P25 digital conventional operation. Mixed mode operation supports fleets of both radio types to allow a gradual migration from analog to digital. The ASTRO site components can be used separately for a single conventional repeater or together for a large statewide or country-wide conventional system.

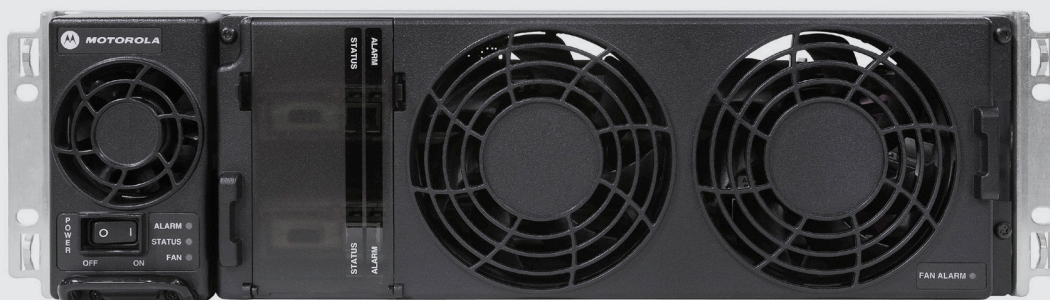
SIMULCAST

When configured for simulcast operation, additional timing and voting equipment allow adjacent sites to utilize the same frequencies with minimal audio degradation. ASTRO sites support both conventional and trunking simulcast systems. Linear Simulcast Modulation (LSM) enables greater spacing without sacrificing coverage or capacity, resulting in fewer sites to build and maintain.

DATA

ASTRO trunking and conventional systems can be enabled with P25 Integrated Data to support basic user data needs. Base station channels can dynamically switch from voice to data based on the call type. ASTRO Enhanced Data optimizes the data channel for applications with a high amount of short inbound data messages like location, telemetry and biometrics, and can improve data efficiency by 12X over standard P25 data.





GTR 8000 BASE RADIO (T7039A)

From conventional to trunking, single repeater to multisite, FDMA to TDMA, and available in multiple frequency bands, the GTR 8000 offers design flexibility and investment protection in a high performance package.

GENERAL SPECIFICATIONS					
		700/800 MHz	UHF Range 1 UHF Range 2	VHF	High Power 800 MHz
Size (HxWxD)		5.25 x 19 x 18 in (133 x 483 x 457 mm)			
Weight		46 lb (21 kg)	46 lb (21 kg)	46 lb (21 kg)	48 lb (22 kg)
Temperature Range		-22 to 140 °F (-30 to 60 °C)			
Power Requirements		AC: 90-264 VAC, 47-63 Hz			
		DC: 43.2-60 VDC			
Power Consumption	Efficiency Package	C4FM, FM: 405 W LSM, H-DQPSK: 425 W	C4FM, FM: 410 W LSM, H-DQPSK: 445 W	C4FM, FM: 405 W LSM, H-DQPSK: 315 W	C4FM, FM: 700 W
	Standard	C4FM, FM: 430 W LSM, H-DQPSK: 470 W	C4FM, FM: 435 W LSM, H-DQPSK: 455 W	C4FM, FM: 435 W LSM, H-DQPSK: 345 W	C4FM, FM: 725 W
Antenna Connectors TX		N female			
Antenna Connectors RX	Standard	BNC female			
	Optional Preselector	N female			
Channel Spacing		12.5/25 kHz	12.5/25 kHz	12.5/15/25/30 kHz	12.5/25 kHz
Modulation	TX	C4FM, LSM, H-DQPSK, FM	C4FM, LSM, H-DQPSK, FM	C4FM, LSM, H-DQPSK, FM	FM, C4FM
	RX	C4FM, H-CPM, FM			
Frequency Stability		100 ppb/2 yr or External Reference			

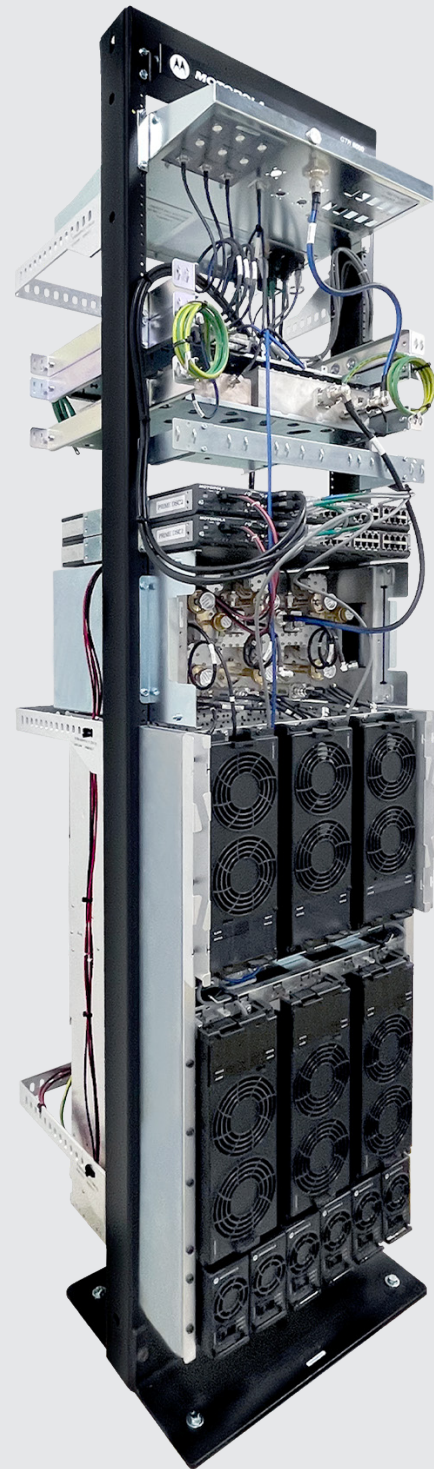
TRANSMITTER				
	700/800 MHz	UHF Range 1 UHF Range 2	VHF	High Power 800 MHz
Frequency Range	764-776, 851-870 MHz	380-435, 435-524 MHz	136-174 MHz	851-870 MHz
Power Output	2-100 W	C4FM, FM: 2-110 W H-DQPSK, LSM: 2-100 W	C4FM, FM: 2-100 W H-DQPSK, LSM: 2-60 W	High Power: 15-150 W Low Power: 2-30 W
Electronic Bandwidth	Full Bandwidth			
Modulation Fidelity	5%			
Intermodulation Attenuation	80 dB	65 dB	55 dB	55 dB
Spurious and Harmonic Emissions Attenuation	90 dB			
Analog FM Hum and Noise	12.5 kHz channel	45 dB		
	25 kHz channel	50 dB		
Analog Audio Distortion	<2% at 1000 Hz	<2% at 1000 Hz (Typical: 1%)	<2% at 1000 Hz (Typical: 1%)	<2% at 1000 Hz
Emissions Designators	8K70D1E, 8K70D1D, 8K70D1W, 8K10F1E, 8K10F1D, 8K10F1W, 10K0F1E, 10K0F1D, 10K0F1W, 9K80D7E, 9K80D7D, 9K80D7W, 17K7D7D, 16K0F1D, 16K0F3E, 11K0F3E, 14K0F1D, 14K0F3E, 21K7D7E, 21K7D7D, 21K7D7W	8K70D1E, 8K70D1D, 8K70D1W, 8K10F1E, 8K10F1D, 8K10F1W, 9K80D7E, 9K80D7D, 9K80D7W, 10K0F1D, 11K0F3E, 16K0F1D, 16K0F3E	8K70D1E, 8K70D1D, 8K70D1W, 8K10F1E, 8K10F1D, 8K10F1W, 9K80D7E, 9K80D7D, 9K80D7W, 10K0F1D, 11K0F3E, 16K0F1D, 16K0F3E	High Power: 8K10F1E, 8K10F1D, 8K10F1W, 16K0F1D, 16K0F3E, 11K0F3E, 14K0F1D, 14K0F3 Low Power: 8K10F1D, 8K10F1E, 8K10F7W, 8K70D1W, 8K70D7W, 9K80D7W, 10K0F1D, 11K0F3E, 16K0F3E, 16K0F1D

RECEIVER					
		700/800 MHz	UHF Range 1 UHF Range 2	VHF	High Power 800 MHz
Frequency Range		792-825 MHz	380-435, 435-524 MHz	136-174 MHz	806-825 MHz
Analog Sensitivity (12 dB SINAD)	12.5 kHz channel	-118 dBm	-118 dBm	-119 dBm	-118 dBm
	25 kHz channel	-117 dBm	-117 dBm	-118 dBm	-117 dBm
Digital Sensitivity (5% BER)	C4FM	-118 dBm	-118 dBm	-119 dBm	-118 dBm
	H-CPM	-116 dBm	-116 dBm	-117 dBm	-116 dBm
Intermodulation Rejection		85 dB			
Digital Adjacent Channel Rejection		60 dB			
Analog Adj Channel Rejection (EIA603)	12.5 kHz channel	75 dB			
Analog Adj Channel Rejection (TIA603D)	12.5 kHz channel	50 or 60 dB (adjustable)			
	25 kHz channel	80 dB			
Spurious and Image Response Rejection	Standard	85 dB	85 dB	90 dB	85 dB
	With optional preselector	100 dB	100 dB	95 dB	100 dB
Analog Audio Response		+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output			
Analog Audio Distortion		3% or 5% (adjustable)			
Analog FM Hum and Noise	12.5 kHz channel	45 dB			
	25 kHz channel	50 dB			
Intermediate Frequency	First	73.35 MHz	73.35 MHz	44.85 MHz	73.35 MHz
	Second	2.16 MHz			

GTR 8000 EXPANDABLE SITE SUBSYSTEM (SQM01SUM7054A)

The single rack design of the GTR 8000 Expandable Site Subsystem (ESS) houses up to 6 channels with RF distribution and power systems. Factory-configured and tuned to your specific system, it makes installation quick and easy. Connect multiple ESS racks to achieve maximum site capacity.

GENERAL SPECIFICATIONS						
		700/800 MHz	UHF Range 1 UHF Range 2	VHF	High Power 800 MHz	900 MHz
Number of Channels		1 to 6	1 to 6	1 to 6	2 to 6	1 to 6
Height with 7.5 ft Rack		90.4 in (2300 mm)				
Footprint (W x D) with 7.5 ft Rack		20.5 x 23.5 in (520 x 600 mm)				
Weight with 7.5 ft Rack		520 lb (235 kg)	UHF R1: 475 lb (215 kg) UHF R2: 565 lb (260 kg)	475 lb (215 kg)	538 lb (246 kg)	575 lb (260 kg)
Temperature Range		-22 to 140 °F (-30 to 60 °C)				
Power Requirements		AC: 90-264 VAC, 47-63 Hz, DC: 43.2-60 VDC				
Power Consumption	C4FM,FM	2900 W	2500 W	2650 W	4580 W	3700 W
	LSM, H-DQPSK	3100 W	2700 W	2200 W	N/A	4100 W
	C4FM,FM (Efficiency Package)	2755 W	2325 W	2500 W	4310 W	3700 W
	LSM, H-DQPSK (Efficiency Package)	2900 W	2500 W	2100 W	N/A	4100 W
Antenna Connectors	TX	7/16 or N Female	7/16 Female	N Female	N Female	7/16 Female
	RX	N Female	N Female	BNC Female	N Female	N female
Channel Spacing		12.5/25 kHz	12.5/25 kHz	12.5/15/ 25/30 kHz	12.5/25 kHz	12.5 kHz
Transmit Combiner Spacing		100 or 150 kHz	150 kHz (450 - 512 MHz) N/A (380-450, 512-524 MHz)	N/A	N/A	12.5 kHz (Hybrid) 150 kHz (Cavity)
Modulation	TX	C4FM, LSM, H-DQPSK, FM	C4FM, LSM, H-DQPSK, FM	C4FM, LSM, H-DQPSK, FM	FM, C4FM	C4FM, LSM, H-DQPSK
	RX	C4FM, H-CPM, FM	C4FM, H-CPM, FM	C4FM, H-CPM, FM	C4FM, H-CPM, FM	C4FM, H-CPM
Frequency Stability		Repeater Site: 100 ppb/2 yr				
		Simulcast (Multisite): GPS synchronized				



TRANSMITTER (CABINET OUTPUT)

700/800 MHz		UHF Range 1 UHF Range 2		VHF	High Power 800 MHz	900 MHz	
Frequency Range		764-776, 851-870 MHz		380-435, 435-524 MHz	136-174 MHz	851-870 MHz	935-941 MHz
Power Output		1-40 W		C4FM, FM: 2-110 W (380-450, 512-524 MHz) LSM, H-DQPSK: 2-100 W (380-450, 512-524 MHz) C4FM, FM: 1-33 W (450-512 MHz) LSM, H-DQPSK: 1-30 W (450-512 MHz)	C4FM, FM: 2-100 W LSM, H-DQPSK: 2-60 W	13-134 W	2-way Hybrid: 1-37 W 3-way Hybrid: 1-22 W 4-way Hybrid: 1-17 W 5-way Hybrid: 1-12 W 6-way Hybrid: 1-10 W
Modulation Fidelity		5%					
Intermodulation Attenuation		80 dB	80 dB (450-512 MHz), 65 dB (380-450, 512-524 MHz)	55 dB	55 dB	80 dB	
Spurious / Harmonic Emissions Attenuation		90 dB					
Analog FM Hum / Noise	12.5 kHz channel	45 dB	45 dB	45 dB	TBA	N/A	
	25 kHz channel	50 dB	50 dB	50 dB	TBA	N/A	
Analog Audio Distortion		<2% at 1000 Hz, 1% typ for UHF and VHF bands					
Emissions Designators		8K70D1E, 8K70D1D, 8K70D1W, 8K10F1E, 8K10F1D, 8K10F1W, 10K0F1E, 10K0F1D, 10K0F1W, 9K80D7E, 9K80D7D, 9K80D7W, 17K7D7D, 16K0F1D, 16K0F3E, 11K0F3E, 14K0F1D, 14K0F3E, 21K7D7E, 21K7D7D, 21K7D7W	8K70D1E, 8K70D1D, 8K70D1W, 8K10F1E, 8K10F1D, 8K10F1W, 9K80D7E, 9K80D7D, 9K80D7W, 10K0F1D, 11K0F3E, 16K0F1D, 16K0F3E	8K70D1E, 8K70D1D, 8K70D1W, 8K10F1E, 8K10F1D, 8K10F1W, 9K80D7E, 9K80D7D, 9K80D7W, 10K0F1D, 11K0F3E, 16K0F1D, 16K0F3E	8K10F1E, 8K10F1D, 8K10F1W, 10K0F1E, 10K0F1D, 10K0F1W, 16K0F1D, 16K0F3E, 11K0F3E, 14K0F1D, 14K0F3E	8K70D1E, 8K70D1D 8K70D1W, 8K10F1E 8K10F1D, 8K10F1W 9K80D7E, 9K80D7D 9K80D7W, 10K0F1D 11K0F3E, 16K0F1D 16K0F3E	

Does not include Transmitter RF Distribution System for VHF, UHF 380-450, 512-524 MHz and High Power 800 MHz.

RF DISTRIBUTION SYSTEM (TX)

700/800 MHz Cavity		900 MHz Hybrid	UHF Cavity
Frequency Range	764-776 MHz 851-870 MHz	935-941 MHz	450-512 MHz
Insertion Loss (150 kHz spacing)	3.1 dB typ	2-way loss: 4.4 dB typ 3-way loss: 6.3 dB typ 4-way loss: 7.6 dB typ 5-way loss: 8.8 dB typ 6-way loss: 9.7 dB typ	4.5 dB typ
Tx-Tx Isolation (150 kHz spacing)	32 dB	20 dB	32 dB

RF DISTRIBUTION SYSTEM (RX)

700/800/900 MHz		UHF	
Frequency Range	792-825 MHz or 896-902 MHz	450-512 MHz	
Noise Figure	Typ / Limit	3.8 / 5 dB	4.6 / 5.5 dB
Gain	Typ / Limit	13 / -16 to 24 dB adjustable	10 / -16 to 24 dB adjustable
3rd Order Output Intercept (Typ)	21 dBm	19 dBm	
Amplifier Intercept	35 dBm	40 dBm	
Preselector Bandwidth	792-825 MHz or 896-902 MHz	2 or 3.5 MHz	
RF Input Connector Type	N (Female)	N (Female)	
RF Output Connector Type	BNC (Female)	BNC (Female)	

RECEIVER (TOP OF CABINET)						
		700/800 MHz	UHF Range 1 UHF Range 2	VHF	High Power 800 MHz	900 MHz
Frequency Range		792-825 MHz	380-435, 435-524 MHz	136-174 MHz	806-825 MHz	896-902 MHz
Analog Sensitivity (12 dB SINAD)	12.5 kHz channel	-123 dBm	-117 dBm (380-450, 512-524 MHz) -121.5 dBm (450-512 MHz)	-118 dBm (12.5/15 kHz)	-123 dBm	N/A
	25 kHz channel	-122 dBm	-116 dBm (380-450, 512-524 MHz) -120.5 dBm (450-512 MHz)	-117 dBm (25/30 kHz)	-122 dBm	N/A
Digital Sensitivity (5% BER)	C4FM	-123 dBm	-117 dBm (380-450, 512-524 MHz) -121.5 dBm (450-512 MHz)	-118 dBm	-123 dBm	-123 dBm
	H-CPM	-121 dBm	-115 dBm (380-450, 512-524 MHz) -119.5 dBm (450-512 MHz)	-116 dBm	N/A	-121 dBm
Intermodulation Rejection		80 dB				
Digital Adjacent Channel Rejection		60 dB				
Analog Adjacent Channel Rejection (EIA603)	12.5 kHz channel	75 dB	75 dB	75 dB	75 dB	N/A
Analog Adjacent Channel Rejection (TIA603D)	12.5 kHz channel	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)	N/A
	25 kHz channel	80 dB	80 dB	80 dB	80 dB	N/A
Spurious and Image Response Rejection		100 dB	85 dB (380-435 MHz)	90 dB	100 dB	100 dB
			100 dB (450-512 MHz)			
Analog Audio Response		+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output				N/A
Analog Audio Distortion		3% or 5% (adjustable)	3% or 5% (adjustable)	3% or 5% (adjustable)	3% or 5% (adjustable)	N/A
Analog FM Hum / Noise	12.5 kHz channel	45 dB	45 dB	45 dB	45 dB	N/A
	25 kHz channel	50 dB	50 dB	50 dB	50 dB	N/A
Intermediate Frequency	First	73.35 MHz	73.35 MHz	44.85 MHz	73.35 MHz	73.35 MHz
	Second	2.16 MHz				

GCM 8000 COMPARATOR (T7321A)

GENERAL SPECIFICATIONS	
TRUNKING SYSTEMS	
Channel Capacity	1 or 2
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)
Weight	40 lb (18 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)
Rack Option	19 in standard rack mountable
Time Stability	External Reference
Power Requirements	AC: 90-264 VAC 47-63Hz DC: 43.2-60 VDC
Power Consumption	AC: 1 module 130 W AC: 2 modules 160 W DC: 1 module 60 W DC: 2 modules 80 W

GRV 8000 COMPARATOR (T8341A)

GENERAL SPECIFICATIONS	
CONVENTIONAL SYSTEMS	
Channel Capacity	1 or 2
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)
Weight	36 lb (16 kg)
Temperature Range	-22 to 140°F (-30 to 60°C)
Rack Option	19 in standard rack mountable
Time Stability	External Reference
Power Requirements	AC: 90-264 VAC 47-63Hz DC: 43.2-60 VDC
Power Consumption	AC: 1 module 80 W AC: 2 modules 105 W DC: 1 module 50 W DC: 2 modules 75 W

GPW 8000 RECEIVER (T7540A)

GENERAL SPECIFICATIONS					
		700/800 MHz	UHF Range 1	VHF	900 MHz
Frequency Range		792-825 MHz	380-435, 435-524 MHz	136-174 MHz	896-902 MHz
Size (HxWxD)		5.25 x 19 x 18 in (133 x 483 x 457 mm)			
Weight		36 lb (16 kg)			
Temperature Range		-22 to 140°F (-30 to 60°C)			
Power Requirements		AC: 90-264 VAC 47-63Hz or DC: 43.2-60 VDC			
Power Consumption (1 Module / 2 Modules)		AC: 80 / 105 W or with AC Power Efficiency Package: 40 / 65 W			
		DC: 50 / 75 W or with DC Power Efficiency Package: 30 / 50 W			
Antenna Connectors	Standard	BNC Female			
	With Optional Preselector	N Female			
Modulation		C4FM, FM			
Frequency Stability		Conventional: 100 ppb/2 yr			
Analog Sensitivity (12 dB SINAD)	12.5 kHz channel	-118 dBm	-118 dBm	-119 dBm (12.5/15 kHz)	N/A
	25 kHz channel	-117 dBm	-117 dBm	-118 dBm (25/30 kHz)	N/A
Digital Sensitivity (5% BER)	C4FM	-118 dBm	-118 dBm	-119 dBm	-118 dBm
	H-CPM	-116 dBm	-116 dBm	-117 dBm	-116 dBm
Intermodulation Rejection		85 dB	85 dB	85 dB	N/A
Digital Adjacent Channel Rejection		60 dB	60 dB	60 dB	N/A
Analog Adjacent Channel Rejection (EIA603)	12.5 / 25 kHz channel	75 dB	75 dB	75 dB	TBA
Analog Adjacent Channel Rejection (TIA603D)	12.5 kHz channel	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)	50 or 60 dB (adjustable)	TBA
	25 kHz channel	80 dB	80 dB	80 dB	TBA
Spurious and Image Response Rejection	Standard	85 dB	85 dB	90 dB	90 dB
	With Optional Preselector	100 dB	100 dB	95 dB	N/A
Analog Audio Response		+1, -3 dB from 6 dB per octave de-emphasis; 300-3000 Hz referenced to 1000 Hz at line output			
Analog Audio Distortion		3% or 5% (adjustable)			
Analog FM Hum and Noise		12.5 kHz channel: 45 dB, 15 kHz channel: 50 dB			
Intermediate Frequency	First	73.35 MHz	73.35 MHz	44.85 MHz	73.35 MHz
	Second	2.16 MHz			

GCP 8000 SITE CONTROLLER (T7038A)

GENERAL SPECIFICATIONS			
Channel Capacity	Repeater Site: 28	Rack Option	19 in standard rack mountable
	Simulcast (Multicast): 30	Frequency Stability	Simulcast (Multisite): External
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)	Power Requirements	AC: 90-264 V, 47-63 Hz or DC: 43.2-60 V
Weight	40 lb (18 kg)	Power Consumption	AC: 130 W, DC: 60 W
Temperature Range	-22 to 140 °F (-30 to 60 °C)		

DSC 8000 SITE CONTROLLER /
REFERENCE DISTRIBUTION MODULE (T8810A)

GENERAL SPECIFICATIONS			
Channel Capacity	Repeater Site: 28	Rack Option	19 in standard rack mountable
	Simulcast (Multicast): 30	Frequency Stability	Opt. redundant GPS, Opt. redundant GPS with Rubidium extended hold-over, or External Reference
Size (HxWxD)	1.72 x 19 x 15.98 in (43.8 x 483 x 406 mm)	Power Requirements	AC: 90-264 V, 47-63 Hz or DC: 26.5-60 V
Weight	19.8 lb (9 kg)	Power Consumption	AC: 115 W, DC: 100 W
Temperature Range (Operating)	-22 to 140 °F (-30 to 60 °C)	Relative Humidity	15% to 90%, non-condensing
Temperature Range (Non-Operating)	-40 to 185 °F (-40 to 85 °C)		



DSC 8000 Site Controller /
Reference Distribution Module (T8810A)

DSC 8000 AC POWER SUPPLY (T8811A)

GENERAL SPECIFICATIONS			
Size (HxWxD)	1.72 x 19 x 15.98 in (43.8 x 483 x 406 mm)	Rack Option	19 in standard rack mountable with included brackets
Weight	22.4 lb (10.2kg)	Power Requirements	AC: 90-264 V, 47-63 Hz
Temperature Range (Operating)	-22 to 140 °F (-30 to 60 °C)	Power Consumption (per DSC 8000)	AC: 115 W
Temperature Range (Non-Operating)	-40 to 185 °F (-40 to 85 °C)	Relative Humidity	15% to 90%, non-condensing



DSC 8000 AC Power Supply (T8811A)

DSC HUB (T7038A)

GENERAL SPECIFICATIONS (CHASSIS WITH 2 DSC HUBS)			
Channel Capacity	6 channels	Rack Option	19 in standard rack mountable
Size (HxWxD)	5.25 x 19 x 18 in (133 x 483 x 457 mm)	Power Requirements	Powered by GTR 8000 / GPW 8000
Weight	33 lb (15 kg)	Power Consumption	DC: 22 W
Temperature Range (Operating)	-22 to 140 °F (-30 to 60 °C)	Relative Humidity	15% to 90%, non-condensing
Temperature Range (Non-Operating)	-40 to 185 °F (-40 to 85 °C)		



G-SERIES COMPACT SITE

Protected from the elements, the G-Series Compact Site is a complete ASTRO site that can house up to three GTR 8000 Base Radios in an outdoor, environmentally controlled cabinet. It is ideal for Project 25 (P25) deployments where building enclosures are not cost effective or not feasible due to difficult terrain.

Frequency Band	700 MHz, 800 MHz
Size (HxWxD)	51.2 x 27.2 x 36.5 in (1300 x 690 x 925 mm): Pole Mount 59.5 x 27.2 x 36.5 in (1510 x 690 x 925 mm): Pad Mount 55.3 x 27.2 x 36.5 in (1405 x 690 x 925 mm): Wall Mount
Weight	230 lb (104 kg) empty, 460 lb (209 kg) fully loaded
Temperature Range (External to Cabinet)	-22 to 122 °F (-30 to 50 °C)
Mounting Options	Pole, Pad, or Wall Mountable



SERVICES

Choose the right level of services you need to achieve mission-critical performance for your ASTRO system. The more you engage Motorola Solutions, the more you transfer the risk to us and achieve peace of mind in maximizing your uptime.



ESSENTIAL

Technical support when and where you need it, so you can maintain and restore your system.



ADVANCED

Rely on us to monitor and update your network, providing improved network response and continuity.



PREMIER

Transfer day-to-day accountability to us to operate and optimize all or part of your system to maximize performance and reduce risk.



FCC TYPE ACCEPTANCE			
Frequency Range	Type	Power Output	Type Acceptance Number
136-174 MHz	Transmitter	2-100 W	ABZ89FC3790B, ABZ89FC3799B
136-174 MHz	Receiver	N/A	ABZ89FR3791B
406-435 MHz	Transmitter	2-110 W	ABZ89FC4821C
406-435 MHz	Receiver	N/A	ABZ89FR4822B
435-512 MHz	Transmitter	2-110 W	ABZ89FC4819C
435-512 MHz	Receiver	N/A	ABZ89FR4820B
764-776 MHz	Transmitter	2-100 W	ABZ89FC5812B
851-870 MHz	Transmitter	2-100 W	ABZ89FC5810B
792-825 MHz	Receiver	N/A	ABZ89FR5811B
935-941 MHz	Transmitter	2-120 W	ABZ89FC5823B
896-902 MHz	Receiver	N/A	ABZ89FR5824B
851-870 MHz	Transmitter	15-150 W	ABZ89FC5825B

EU REGULATORY COMPLIANCE

CE mark is available on the GTR 8000 Base Radio (T7039A) and GPW 8000 Receiver (T7540A) in the following frequency ranges: UHF 380-525 MHz and VHF 136-174 MHz.

NOTES

- All specifications shown are typical unless otherwise noted.
- All specifications are subject to change without notice.

For more information, please visit us on the web at: www.motorolasolutions.com/ASTRO



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SECURESYNC 2400

Resilient Time and Frequency Synchronization Platform



Resilient Time and Frequency Synchronization Platform

Resilient Timing depends on securing the time reference acquisition and timescale keeping, in the face of GNSS interference. Government recommendations, like the Executive Order in the US or the Cybersecurity Act in European Union, pave the way for future regulations in this domain.

The SecureSync product ecosystem offers a number of solutions to address GNSS threats. With a layered-defense approach, each protective layer increases the sophistication required to compromise, minimizing chances for successful attack.

SecureSync relies on the proven Interference Detection Suite, allowing jamming and spoofing detection. Threats are mitigated by high-performance internal oscillators, or through strong modularity and choice of input interfaces, building redundancy into the timing system architecture.

Whatever your industry, there is a cost-effective SecureSync configuration that keeps your time distribution accurate and available.

Key Features

- Multi-GNSS synchronization (GPS, Galileo, GLONASS, BeiDou, QZSS)
- GPS jamming and spoofing detection option
- Internal precision timekeeping via TCXO, OCXO or Rb oscillator
- Supports a wide variety of available input/output signals
- Modular (configure-to-order)
- Exceptional operating temperature range of -20°C to +65°C
- High bandwidth NTP
- PTP v2 Master/Slave
- Dual Gb Ethernet
- Secure network management: Enable or disable protocols for encryption, authentication, authorization and accounting
- REST API management
- Alert notifications via SNMP traps and email alert
- Industry-leading five year limited warranty

Safran Federal Systems is the trusted Resilient PNT mission partner to U.S. government and defense organizations, from the lab to the field.

Security

SecureSync 2400 is designed with security in mind, combining cybersecurity best practices, including VLAN support account/access management, authentication, encryption, security event logs, network features disabling, as well as regular, secured firmware updates to keep pace with the latest vulnerabilities and protocol improvements.

Networking that Scales

SecureSync 2400 provides strong and scalable networking capability, thanks to higher embedded processing power. Two Gigabit Ethernet ports (one RJ45, one SFP) are available on the base unit enabling flexible network synchronization as a NTP server or PTP slave/master, as a NTP stratum 2 server, or as a PTP slave/boundary clock.

New generation network option cards (1204-49 and 4A) provide additional dual and quad Gigabit Ethernet SFP ports, embedding their own processing capability and offering further capabilities as NTP server and future PTP slave/master. Scaling up network timing distribution or adding timing redundancy in the network becomes easy.

Modularity

For applications that use “physical” timing signals and require multiple interface types, SecureSync 2400 offers unmatched modularity and a choice of more than 40 option cards.

The base unit provides configurable Input/Output timing interfaces (TTL pulse, RS232/RS485, IRIG AM /DCLS), on top of 10 MHz and 1 pps outputs. If more interfaces are needed, the base unit supports either 2 (2402) or 6 (2406) option card slots, enabling whatever combination of frequency, phase, NMEA or Have Quick time codes, and network synchronization is needed.

Reliability

At the appliance level, SecureSync includes an optional, dual (redundant), hot swappable power supply combined with AC, 12 VDC or 24/48 VDC power modules. Modularity enables multiple time reference management as well as redundant time distribution architectures, which is instrumental to system-level reliability. Any failure is identified and reported in real time, reducing periods of unavailability.

Monitoring

SecureSync 2400 embeds local and remote monitoring tools, including detailed event logs, real-time access to health and operation status, timing performance graphs, and alerts. Integration into automated monitoring systems is supported with legacy protocols like SNMP as well as the more recent REST API. Quick, local diagnostics are accelerated thanks to the front panel indicators and OLED display.



Technical Specifications

Specifications

See option card descriptions for additional performance specifications

10 MHz Frequency Output

Internal Oscillator	TCXO	OCXO	OCXO LPN	Rubidium	Rub LPN
Accuracy (average over 24 hours when GPS locked)	1 x 10 ⁻¹²	4 x 10 ⁻¹²	3 x 10 ⁻¹²	1 x 10 ⁻¹²	1 x 10 ⁻¹²
Medium Term Stability (without GPS after 2 weeks of GPS lock)	1 x 10 ⁻⁸ /day	5 x 10 ⁻¹⁰ /day	2 x 10 ⁻¹⁰ /day	5 x 10 ⁻¹¹ /month (3 x 10 ⁻¹¹ /month typ)	
Short Term Stability (Allan Deviation)					
1 sec	2.5 x 10 ⁻⁹	1 x 10 ⁻¹¹	1 x 10 ⁻¹¹	1 x 10 ⁻¹¹	1 x 10 ⁻¹¹
10 sec	1 x 10 ⁻⁹	9 x 10 ⁻¹²	9 x 10 ⁻¹²	9 x 10 ⁻¹²	1 x 10 ⁻¹¹
100 sec	5 x 10 ⁻¹⁰	9 x 10 ⁻¹²	8 x 10 ⁻¹²	4 x 10 ⁻¹²	5 x 10 ⁻¹²
Temperature Stability (peak-to-peak)	1 x 10 ⁻⁶	5 x 10 ⁻⁹	2 x 10 ⁻⁹	1 x 10 ⁻¹⁰	1 x 10 ⁻¹⁰
Phase Noise (dBc/Hz)					
@1 Hz	—	-95	-100	-80	-100
@10 Hz	—	-123	-128	-98	-128
@100 Hz	-110	-140	-148	-120	-148
@1 kHz	-135	-145	-150	-140	-150
@10 kHz	-140	-150	-150	-140	-150
Signal waveform and levels: +13 dBm Sine into 50 ohm, BNC					

1 PPS Timing Output

	TCXO	OCXO	OCXO LPN	Rubidium	Rub LPN
Accuracy to UTC (1-sigma locked to GPS)	± 50 ns	± 50 ns	± 15 ns	± 25 ns	± 15 ns
Holdover (constant temp after 2 weeks of GPS lock)					
After 4 hours	12 μ s	1 μ s	0.5 μ s	0.2 μ s	0.2 μ s
After 24 hours	450 μ s	25 μ s	10 μ s	1 μ s	1 μ s
Signal waveform and levels: TTL (5V _{p-p}), into 50 ohm, BNC					

Timing Signals

10 MHz Sine Output, BNC

SW Configurable Timing Output, BNC

- TTL Output (1 PPS, xPPS [output only], IRIG DCLS, HAVE QUICK)

SW Configurable Timing Input, HD-15

- TTL Input/Output (1 PPS, xPPS [output only],
- IRIG DCLS, HAVE QUICK)
- RS-232 Input/Output (NMEA, ASCII ToD)
- RS-485 Input/Output (1 PPS, xPPS [output only], IRIG DCLS, HAVE QUICK, NMEA, ASCII ToD)
- IRIG AM Output

Network Services

Timing

- NTP v2, v3, v4: Conforms with RFC 1305 and 5905. Supports Unicast, Broadcast, Multicast, Symmetric Key Encryption, Peering, Stratum 2
- SNTP v3, v4: Conforms with RFC 1769, 2030, 4330, and 5905
- PTP v2: Conforms with IEEE 1588:2019. Supports Master, Slave, E2E, IPv4/v6, Multicast, Unicast, Hybrid modes
- PTP supported profiles: default, power (IEEE 61850-9-3, IEEE C37.238-2011/2017), telecom (ITU-T G.8265.1, G.8275.2 master only)

Management & communications

- IPv4/IPv6: Dual stack
- VLAN support
- DHCPv4/DHCPv6 (AUTOCONF)/SLAAC: Automatic IP address assignment
- Syslog: Logging
- HTTP(S): Browser-based configuration and monitoring
- REST API configuration and monitoring
- (S)FTP Server: Access to files (logs, etc.)
- SNMP: Supports v1, v2c, and v3 (no auth/auth/priv) with Enterprise MIB
- SMTP: Email

Security Features

- Configurable Password Policy
- Authentication: LDAP, RADIUS, TACACS+
- Enable/Block protocols
- Access Control Lists
- HTTP Strict Transport Security (HSTS) support
- SSL/SSH
- TLS v1.2, v1.3
- SFTP/SCP: Securely transfers files to and from the time server over an SSH session
- SNMP v3: Remotely configure and manage over an encrypted connection
- Alert notifications via SNMP traps and email
- Signed software updates

GNSS Receiver

- Connector: Type SMA with Type N cable adapter, +5V to power active antenna (+3.3V for optional SAASM)
- Frequency: GPS L1 (1575.42 MHz), Galileo E1 (1575.42 MHz), GLONASS L1 (1602.0 MHz), BeiDou B1 (1561.1 MHz), QZSS L1 (1575.42 MHz).
- Satellite tracking: 1 to 72, T-RAIM satellite error management
- Synchronization time: cold start < 15 minutes (includes almanac download), warm start < 5 minutes (assumes almanac downloaded)
- Antenna system: sold separately.

Communications

Network Port

- Dual Gb Ethernet (one RJ-45, one SFP)

Serial Set-up Interface

- RS-232 communications on front panel micro USB, rear panel RJ-45

Front Panel

- LED segments for time display
- OLED menu display and keypad for status and basic configuration
- LED status buttons with one-click menu access

Power

- Fixed 100-240 VAC, 50/60 Hz, ±10% from IEC60320 (option 0) connector; power cord included
- Fixed 12 VDC (option 3) or 24/48 VDC (option 4); mating connector and cable clamp included
- Optional dual hot-swap power with load-sharing and failover

Power Draw

- TCXO: 40 W normal (50 W start-up)
- OCXO: 40 W normal (50 W start-up)
- Rubidium: 50 W normal (80 W start-up)

Physical & Environmental

Size/Weight

- Designed for EIA 19" rack. 17.1" W x 1.74" H (1U) x 15.17" D (434 mm W x 44 mm H x 385 mm D)
- Weight : 6.0 lbs (2.72 kg) for base unit with AC power supply
- Front rack mount hardware included (assembly required)

Warranty

Five Year Limited Warranty¹

- Oscillator for rubidium option is warranted for two years
- Extended warranty is available

¹The warranty period may be dependent on country.

Environmental

	Operating	Storage
Temp	-20 to +65°C (+55°C for Rb)	-40 to +85°C
Humidity	0%-95% RH non-condensing @ 40°C	
Altitude	100-240 VAC up to 13,123 ft (4,000 m)	45,000 ft (13,700)
Shock	MIL-STD-810H, 516.8 15g, 11 ms halfsine	
Vibration	MIL-STD-810H, 514.8C-2 cat 4 and 514.8D-11, cat 21 1.1 g rms vertical and 0.8 vertical and 0.8 g rms longitudinal	

Agency Approvals

CE, TUV, cTUV, FCC part 15 class A, RoHS, REACH, WEEE

Ordering Information

Base Units: 240w-xyz

Select expansion capability, power, internal oscillator and GNSS options:

w=Expansion	x=Power	y=Internal Oscillator	z=GNSS Reference
2 = 2 Option Slots 6 = 6 Option Slots	0 = AC 3 = 12 VDC 4 = 24/28 VDC 6 = Dual Hot-Swap support ²	0 = TCXO 1 = OCXO 2 = Low Phase Noise OCXO 3 = Rubidium 5 = Low Phase Noise Rubidium	3 = Multi-GNSS 9 = M-Code

²Dual Hot-Swap requires ordering at least one power module (see power module options below), on top of power option 6 for the base unit.

Example

A SecureSync with 6 slots base unit with fixed AC power, OCXO internal oscillator, and GPS as the primary reference is Model Number 2406-013. Order option modules for additional input/ output functions.

A SecureSync with 2 slots base unit, with Dual Hot Swap AC power supplies, rubidium internal oscillator and GPS as the primary reference requires Model Number 2402-633 and the addition of 2 power supply module 2400-HS-A1

Optional Upgrade

SS-OPT-BSH: GPS Jamming and Spoofing Detection

Option Modules

Up to 2 or 6 option modules can be accommodated per unit.

See Option Module Card datasheet for details

Power Modules

Up to 2 power modules, from below list, shall be ordered with the Dual Hot-Swap power option 6:

- 2400-HS-A1: 100-240 VAC.
- 2400-HS-D1: 12 VDC Hot Swap Power module.
- 2400-HS-D2: 24/48 VDC Hot Swap Power module.

Accessories

- I/O timing signals breakout cable enables conversion from single HD-15 connector to individual BNC and Sub-D connectors
- SFP (copper, FO Single Mode, FO Multi-Mode)
- Ancillary kit, rugged installation

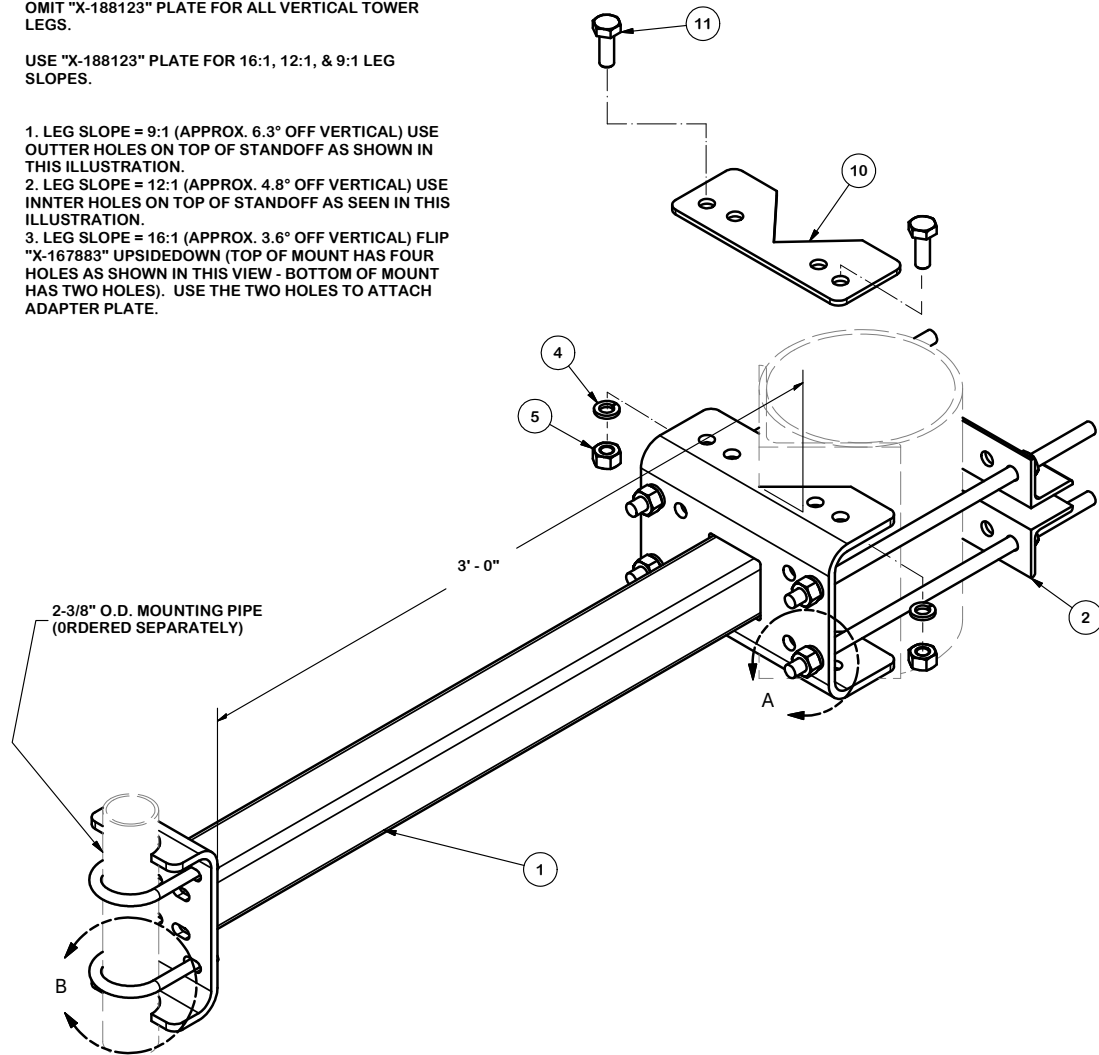


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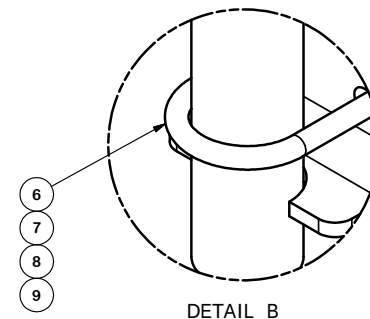
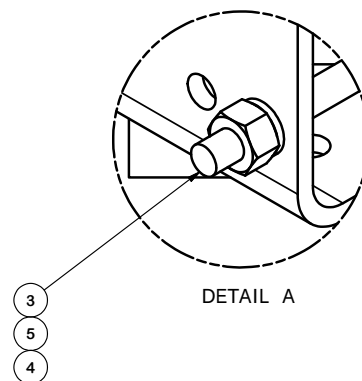
OMIT "X-188123" PLATE FOR ALL VERTICAL TOWER LEGS.

USE "X-188123" PLATE FOR 16:1, 12:1, & 9:1 LEG SLOPES.

1. LEG SLOPE = 9:1 (APPROX. 6.3° OFF VERTICAL) USE OUTER HOLES ON TOP OF STANDOFF AS SHOWN IN THIS ILLUSTRATION.
2. LEG SLOPE = 12:1 (APPROX. 4.8° OFF VERTICAL) USE INNER HOLES ON TOP OF STANDOFF AS SEEN IN THIS ILLUSTRATION.
3. LEG SLOPE = 16:1 (APPROX. 3.6° OFF VERTICAL) FLIP "X-167883" UPSIDEDOWN (TOP OF MOUNT HAS FOUR HOLES AS SHOWN IN THIS VIEW - BOTTOM OF MOUNT HAS TWO HOLES). USE THE TWO HOLES TO ATTACH ADAPTER PLATE.



PARTS LIST					
ITEM	QTY	PART NO.	PART DESCRIPTION	LENGTH	UNIT WT. NET WT.
1	1	X-167883	SQUARE TUBE WELDMENT		39.72 39.72
2	2	X-113526	BACKING ANGLE	11 3/4 in	3.89 7.79
3	4	G58R-18	5/8" x 18" THREADED ROD (HDG.)		0.35 1.41
4	10	G58LW	5/8" HDG LOCKWASHER		0.03 0.26
5	10	G58NUT	5/8" HDG HEAVY 2H HEX NUT		0.13 1.30
6	2	X-UB1212	1/2" X 2-1/2" X 4-1/2" X 2" U-BOLT (HDG.)		0.63 1.25
7	4	G12FW	1/2" HDG USS FLATWASHER		0.03 0.14
8	4	G12LW	1/2" HDG LOCKWASHER		0.01 0.06
9	4	G12NUT	1/2" HDG HEAVY 2H HEX NUT		0.07 0.29
10	1	X-188123	ADAPTER PLATE #3 (MICRO #35-113994)	4 in	2.29 2.29
11	2	G58134	5/8" x 1-3/4" HDG BOLT	1 3/4 in	0.27 0.54
				TOTAL WT. #	59.89



NOTE:
THIS STANDOFF FITS THE
FOLLOWING:

- * 1-3/4" THRU 8-5/8" O.D. PIPE LEGS.
- * 2-1/2" THRU 6" ANGLE ;EG TOWERS
- * VERTICAL, 16:1, 12:1, & 9:1 LEG SLOPE

TOLERANCE NOTES

TOLERANCES ON DIMENSIONS, UNLESS OTHERWISE NOTED ARE:
SAWED, SHEARED AND GAS CUT EDGES ($\pm 0.030"$)
DRILLED AND GAS CUT HOLES ($\pm 0.030"$) - NO CONING OF HOLES
LASER CUT EDGES AND HOLES ($\pm 0.010"$) - NO CONING OF HOLES
BENDS ARE $\pm 1/2$ DEGREE
ALL OTHER MACHINING ($\pm 0.030"$)
ALL OTHER ASSEMBLY ($\pm 0.060"$)

PROPRIETARY NOTE:
THE DATA AND TECHNIQUES CONTAINED IN THIS DRAWING ARE PROPRIETARY INFORMATION OF VALMONT INDUSTRIES AND CONSIDERED A TRADE SECRET. ANY USE OR DISCLOSURE WITHOUT THE CONSENT OF VALMONT INDUSTRIES IS STRICTLY PROHIBITED.

DESCRIPTION

3'
SIDE ARM
MOUNT

CPD NO. 5092	DRAWN BY CEK 3/29/2011	ENG. APPROVAL
CLASS 81	SUB 01	DRAWING USAGE CUSTOMER
		CHECKED BY BMC 9/16/2011



Engineering
Support Team:
1-888-753-7446

Locations:
New York, NY
Atlanta, GA
Los Angeles, CA
Plymouth, IN
Salem, OR
Dallas, TX

PART NO.	USA3	PAGE 1 OF 1
DWG. NO.	USA3	