SANDVIK

AUTOMINE® LITE 2

TECHNICAL SPECIFICATION



AutoMine® Lite is an automation system for a single Sandvik loader or truck, including both optimized route-based automation and intelligent teleoperation with operator-assisting automatic steering. The solution provides an easy way to start exploring the full potential of Sandvik equipment automation and achieve benefits of increased productivity, safety and cost efficiency in mining operations.

AutoMine® Lite is particularly suitable for mining operations such as sub-level open stoping, sub-level caving, transfer levels or individual block caving drives as for continuously changing mining environments, such as applications with small stopes or mine development.

AutoMine® Lite is compatible with other AutoMine® packages. It can thus be easily upgraded and expanded for use with multiple loaders and trucks operated by each system operator.

AutoMine® Lite system consists of:

- Remote operator station
- Onboard AutoMine® package
- Access Control System for safety isolation
- Wireless communication system

AutoMine® Lite is available in three levels providing single-machine mining operations with the functionality required to achieve the highest productivity, safety and cost efficiency possible.

AutoMine® LITE	BASIC	SILVER	GOLD
	Tele-Remote basic package + Automated functionality and basic information	Basic package + Improved automated functions and extended information	Silver package + Most advanced capability

MAIN FEATURES*



This Technical Specification is for AutoMine® Lite product version 2.	
Operation	Single-machine automation and teleoperation system: • Automated production missions with autonomous tramming (any gear) and dumping, both underground and on the surface • Smart assisted tele-remote tramming (max. 2nd gear) with automatic wall avoidance features • Loader bucket loading with direct tele-remote control or automatic loading assistant • Dumping autonomously or with direct tele-remote control • Interface for rock breakers Information management capabilities: • Production area maps with equipment location tracking • Alert & production monitoring • User & machine management • Playback tool for visual replay of actual operation • Diagnostics & service tools • Reporting
Sub-Systems	• Remote operator station with Supervisory System Software • Access Control System (ACS) with production area isolation for personnel safety • MineLAN with DC power supply for data transfer (possibility to replace with an applicable third party communication network.) • Onboard package with InfraFREE™ system for machine integration
Equipment Compatibility	• Selected Sandvik underground loaders and trucks • Onboard package as equipment factory option or retrofit installation • Integrated into VCM/SICA control system
Main Mining Applications Requirements	• Underground production area with a possibility to isolate it for the automated equipment • No interference by other wireless networks in operation simultaneously in the same production area • Power supply (AC) available for system components
Integration to Mine Systems	• Interfaces for optional connection to mine network backbone (Operates in Internet Protocol -based networks) • Interface for mine reporting systems (Option)
AutoMine® Product Family Compatibility	• Upgradeable for higher levels of AutoMine® automation technology

COMPLIANCE

2006/42/EC Machinery Directive
2014/30/EU Electromagnetic Compatibility (EMC) Directive
2014/53/EU Radio Equipment Directive
EN ISO 12100:2010. Safety of machinery. General principles for design. Risk assessment and risk reduction.
EN ISO 13849-1:2015. Safety of machinery. Safety-related parts of control systems. Part 1: General principles for design
EN ISO 13849-2:2012. Safety of machinery. Safety-related parts of control systems. Part 2: Validation
EN 60204-1:2006/AC:2010. Safety of machinery. Electrical equipment of machines. Part 1: General requirements
AS/NZS 4240.1:2009. Remote control systems for mining equipment. Part 1: Design, construction, testing, installation and commissioning
ISO 15817:2012 Earth-moving machinery. Safety requirements for remote operator control systems

COMPATIBLE EQUIPMENT



Compatible Loader Models	LH307, LH410, LH514, LH514E, LH517, LH517i, LH621, LH621i
Compatible Truck Models	TH540, TH545i, TH551i, TH663i
Machine Control System Requirement	Alternatives: • 5-Module VCM • SICA

*Features vary depending on automation package (Basic, Silver, Gold) selected. See table on page 4.

AutoMine® Onboard Package	Onboard package sold separately from the system - contact Sandvik to confirm compatibility. Supply: • Factory equipment option • Retrofit kit Design: • Distributed design • Compact centralized design
Mandatory Equipment Options	Fire Suppression System alternatives: • Sandvik FS1000 with auto shutdown, Eclipse foam delivered separately, or • ANSUL, 2 tanks, 8 nozzles (CEN), CHECK-FIRE incl. auto engine shut down
Recommended Equipment Options	• Integrated Weighing System • LED Lights • Tyre Pressure Monitoring System • Boom Suspension System • Recovery Kit (Brake release by pulling the hook)

MINE INSTALLATION, ENVIRONMENT AND OPERATIONAL CONDITIONS



Production	• Isolated production area (with ACS barriers)
Tunnel(s)	• Equipment model selection to suit actual tunnel size (recommended minimum 500 mm clearance between equipment and walls/infrastructure on both sides in addition to space required by the equipment; refer to equipment model specific technical specification). • No objects hanging or below laser scanner level along the tramming path
Dumping Point(s)	• A wheel stop block recommended in front of the dumping point when dumping to an orepass, crusher or truck • GPS base station and surface navigation onboard kit required to dump autonomously on surface (option)
Presence of Other Radio Networks	• No other radio networks simultaneously operating in the same area in the same or adjacent frequencies
Distance Between Operator Station and Production Area	Alternatives: • Standard Ethernet copper: up to 90 meters with an individual cable • Multi-mode fiber optic: up to 2 kilometers with an individual cable (fiber optic cables supplied by customer) • Single-mode fiber optic: up to 10 kilometers with an individual cable (fiber optic cables supplied by customer) • Any distance with an external network that provides sufficient data transfer speed and capacity (Refer to third party network requirements)
System Operating Temperature	0 ... +35°C Air humidity (non-condensing) 15% ... 95% (For equipment details refer to loader model specific technical specification)
Mine Power Supply	110-240 VAC, 50/60 Hz
Remote Support Access (Optional)	VPN (Virtual Private Network) connection recommended (Min. 10 Mb/s preferred)

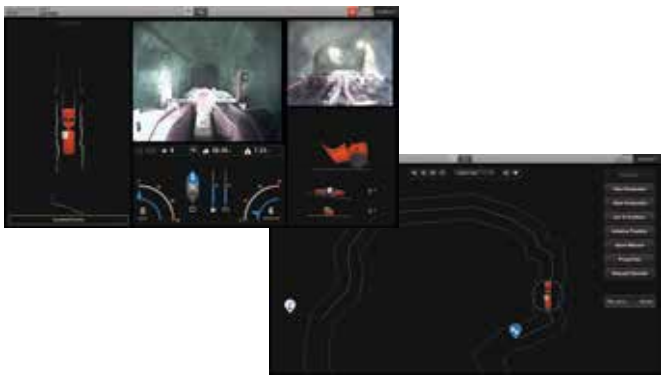
PRODUCT DOCUMENTATION

Product Manuals (English as Default Language)	• System Operator's & Maintenance Manual • System Installation & Commissioning Manual • System Service & Repair Manual • Onboard Automation Operator's & Maintenance Manual • Onboard Automation Service & Repair Manual • Spare Part Manual

SYSTEM GENERAL

Wire Colors of Assemblies	110-240VAC: • IEC/AUS: L=Brown, N=Light Blue • US/CAN: L=Black, N=White 24/48VDC are common: • +24/48V=Red, GND=White, PE=Yellow/Green
ACS Safety Integrity	ACS 2 onwards designed in accordance with ISO13849 (PLc/Performance Level)
External Reporting Interface	SQL view for reporting database queries (Option, refer to a separate interface specification)
AutoMine® L&H Package Upgrades and Compatibility	Remote Operator Station: • Compatible with higher levels of AutoMine® packages Supervisory System: • Backwards compatible also with previous generation ACS 1.0 system • Compatible with both the distributed and single main enclosure onboard package designs Access Control System: • Includes ACS 2 PLC/DIO modules (if ACS 2 is in use) • Full system must use only the same generation of ACS modules • ACS Access Barrier Cabinets support both 24 and 48 VDC input MineLAN Network: • Includes MineLAN 2.1 access point and onboard client modules • Compatible with MineLAN 2 modules • Full system must have compatible network module settings • Access points support both 24 and 48 VDC input • Access point daisy-chains applicable only with 48 VDC Onboard Package: • Compatible with higher levels of AutoMine® packages

PRODUCTION SYSTEM (SUPERVISORY SYSTEM AND INFRAFREE™)



Supervisory System is the AutoMine® sub-system that provides the graphical user interface in the remote operator station.

InfraFREE™ is the AutoMine® sub-system that provides onboard navigation capabilities.

The production system (consisting of Supervisory System and InfraFREE™) features are categorized into three main types: equipment teleoperation (Tele), primarily automatic functionalities (Auto), operator assistive features (Assisted) and system information management capabilities (Info), which are represented by the corresponding prefixes in the feature names.

AutoMine® Lite is available in three packages, which provide different levels of functionality. Each of these features are packaged according to the table below.

AUTOMINE® LITE	BASIC	SILVER	GOLD
Basic features: AutoTram, AutoMissions, AutoProtect, TeleClean, TeleControl, TeleAssist, AutoDump, AssistedSteer, InfoMaps, InfoPlan, ACS 3	•	•	•
Extended features: AutoBreakers, InfoPlayback, InfoReports, AutoRoute-Teach, NoGoZone, AutoSurfaceOperation, OptiMine® integration		•	•
Additional support and training			•

AutoTram	• Automated tramming in-accordance with pre-recorded automation routes at set speeds (no gear limitation)
AutoMissions	• Automated production missions with management commands (start, abort etc.) • Capability to send the equipment to an individual route position or defined destination point • Capability to set temporary route segment-specific speed limits for automated tramming • Capability to block selected route segments or destination points from automated missions as no-go locations
AutoProtect	• Predictive wall collision avoidance with warning indications and automatic braking (in direct tele-remote mode cabin protection and in AssistedSteer mode protection of the entire equipment frame)
TeleClean	• Semi-automated road cleaning mode for loaders: automatic steering based on AutoTram routes while speed and bucket movements are manually controlled (activation of boom floating function enabled)
TeleControl	• Machine teleoperation controls including intelligent VCM/SICA machine control system functions • Video and audio from the machine (front and rear videos with camera toggling) • Dashboard gauges (with equipment type variants) • Remote connection to onboard display (available with compatible VCM/SICA software versions) • Fire suppression remote activation • Power saving sleep mode remote on/off commands • Controls and interface for customer-customized onboard functions
TeleAssist	• Scanner data top-view with wall proximity warnings • Wheel slip and steering alerts • Machine inclinations • Loader boom and bucket or truck box position visualizations
AutoDump	• Automated dumping in-accordance with pre-recorded dumping sequences at dumping point locations defined in AutoTram routes • Capability to store recorded dumping profiles in a library for reuse
AssistedSteer	• Assisted tele-remote mode including automatic steering with operator-controlled maximum speed and gear selection (max. 2nd gear) as well as direction hints (includes AutoProtect wall avoidance capability)
InfoMaps	• Production area layout map view with real-time equipment location tracking and status indication, automation routes and location objects • Area map recorded as part of automation route teaching (no need to import CAD map files) • Capability to store multiple areas by names to select in the beginning of operation • Tools to manage map view (zoom, rotate, home, presets etc.) • Still map and equipment follow-up view modes • Management and location visualization of known navigation obstacles • Area Definition Tool (ADT) for editing map, object locations and route segments

InfoPlan	• Capability to manually assign a production plan to the equipment as AutoMissions between selected destination points • The plan may optionally have a have target based on the number of production cycles or transported tons
AutoBreakers	• System functionality associated with the system's optional hardware interface for remote controlled rock breakers, which are used at the AutoDump dumping points of automated loader(s) • Two-way operation: the loader will wait in a defined distance before approaching the dump point in auto mode, when the rock breaker is active and signals the rock breaker, when the loader is reserving the dump point
InfoPlayback	• Area map view -based diagnostics tool to visually replay actual historical operation and events with the system (based on information automatically recorded in the system database)
InfoReports	• Productivity, utilization and alerts reporting based on data recorded by use of the system • Location-based detailed production cycle breakdown data in productivity report for AutoTram missions • On-screen reports and export tools • External interface for database queries
AutoRouteTeach	• Functionality enables environment and route teaching directly from the control room using the record button on the Supervisory System screen • New route can be recorded in Tele-Remote or Assisted Tele-Remote mode • Adjust speeds and finetune routes through the Area Definition Tool (ADT) and start automated production
NoGoZone	• Feature enables defining no access zones inside the automation area • When a machine is operated into a no access zone the system will stop the machine by sending a fast stop command • These areas can be used to prevent machines from driving into blocked or closed areas and for isolation automated drills working inside the same safety zone • NoGoZone is not an ACS safety function and cannot be used to separate manual operations from automated areas
AutoSurfaceOperation	• Trucks are capable of completing autonomous cycles on the surface • Compatible with TH551i and TH663i
InfoAlerts	• Alarms and warnings in Supervisory System from different sub-system sources including VCM/SICA machine control system, InfraFREE™ navigation and ACS safety system • Real-time notifications and alert history log
InfoTons	• Last and accumulated loader bucket or truck box weights displayed and recorded (actual weights subject to the Integrated Weighing System equipment option) • Manual on-screen bucket/box counter
InfoUsers	• User login with user-specific credentials and language selection • Multiple user access levels
InfoMachines	• Capability to create and store settings for multiple machines enabling a simple machine selection at operation start-up
InfoNetwork	• Network connection status information and quality history log (compatible with MineLAN)
InfoReports	• Productivity, utilization and alerts reporting based on data recorded by use of the system • Location-based detailed production cycle breakdown data in productivity report for AutoTram missions • On-screen reports and export tools • External interface for database queries

SAFETY SYSTEM (ACCESS CONTROL SYSTEM 2)



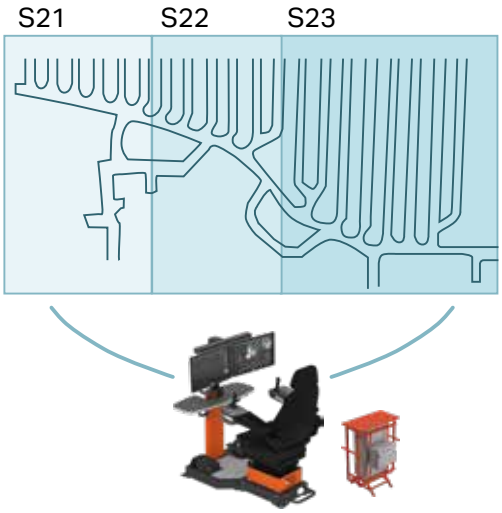
Access Control System is the AutoMine® sub-system for safety isolation of the single machine production area. Only available upon request.

Machine Stopping Safety Functions	• Access barriers with detection devices guard the production area • Fast stop buttons at the remote operator station and at each access barrier
Activation and Use	• Selection of up to 5 installed access barriers for use • A mode for acknowledgement of selected access barriers and the machine during clearance inspection of the production area as part of operation start-up • Key switches for access barrier selections and acknowledgements to enable an administrative control for authentication of safety system users • Visual and audible state indications to users at the remote operator station and at each access barrier • Capability to lock out a certain installed access barrier or an entire ACS safety system from remote use
Installations	• Support for multiple detection device types (light curtains, rope switches and gate switches) • Dual detection devices for machine stopping distance separation • The ACS safety system operates in Internet Protocol -based wireless and wired communication networks shared with other system data

SAFETY SYSTEM (ACCESS CONTROL SYSTEM 3)

Access Control System (ACS) is the AutoMine® sub-system for safety isolation of the autonomous or semi-autonomous equipment from the rest of the mine. Production area can be split to up to 3 safety zones ensuring safe and continuous operation. Machine can be attached freely to any of the safety zones configured to system. Default safety system.

Machine Stopping Safety Functions	• Access barriers with detection devices guard the safety zones (stops the machine in the associated safety zone) • Fast stop button in each remote operator station and at each access barrier (stops the machine in the associated safety zone)
Activation and Use	• Configuration of up to 3 safety zones that can have max 10 access barriers • Configuration of up to 15 machines that can be freely attached to any of the safety zones (only one machine can be operated at a time) • A mode for acknowledgement of configured access barriers and the machine during clearance inspection of the safety zon as part of operation start-up • System state indications and alarms available in ACS GUI in remote operator station • Visual and audible state indications to users at each access barrier



Example: Production area split to 3 safety zones

SYSTEM SERVICE TOOLS

ROUTE DEFINITION TOOL (RDT)



Route Definition Tool (RDT)	Rugged laptop computer with software application for recording and editing production area environment models and routes for automated operation

REMOTE OPERATOR STATION





OPERATOR CHAIR WITH PEDALS

Main Components	• Chair with armrests • Pedals (throttle and brake) • Display (2 pcs); Default: 21,5" rugged touch-screen (24 VDC, IP65). Option: 32" office (110-240 VAC, office plug) • Control panels (2 pcs, left and right); Multiple joystick configuration options for bucket/box control directions in the right control panel • ACS2 user panel (in case ACS 2 is in use) • Speakers • Base with display stand • Cable set to connect to Operator Station Cabinet and Power Supply
Installation	• Intended location: control room, van, trailer, container & etc. (customer supply) • 10-meter cables between Operator Station Cabinet and Power Supply Connection Box
Dimensions	1164 (w) x 1349 (h) x 1457 (d) mm
Weight	~200 kg
Housing	IP65 (control panels and rugged display)
Operating Temperature	0 …. 35°C Air humidity (non-condensing) 15% … 95%
Power Supply	• From Operator Station Cabinet's Power Supply Connection Box • Voltage: 24 VDC

OPERATOR STATION CABINET & POWER SUPPLY

Operator Station Cabinet includes system computers and modules required at the remote operator station. Power Supply box provides power supply to remote operator station system components. These cabinets must be installed close to the remote operator chair within the maximum 10-meter cable length.

Operator Station Cabinet Power	• Supply from operator station power supply connection box • Voltage: 24 VDC • Power consumption: ~200 W for the Operator Station Chair and Cabinet
Power Supply Connection Box	• Output Voltage: 24 VDC, 20 A • Input Voltage: 110-240 VAC, 50/60 Hz, terminal block
Dimensions	• Operator station cabinet: 450 (w) x 810 (h) x 350 (d) mm • (809 (w) x 1068 (h) x 650 (d) mm with floor bracket stand) • Operator station power supply connection box: 380 (w) x 300 (h) x 155 (d) mm
Housing	• IP54 • Enclosure material sheet steel
Data Communication Interfaces	• Ethernet: M12 100 Mb/s, RJ45 100/1000 Mb/s • Optical fiber: single-mode or multi-mode with LC connector
Mounting	Wall mounting, optional floor stand available

OPERATOR STATION OPTIONS (REPLACING OPERATOR CHAIR WITH PEDALS)

OPTION 1: PEDESTAL STAND MOUNTING

Same as Operator Chair with Pedals, except the following:	
Main Components	Pedestal stand (replaces chair with armrests and base with display stand)
Dimensions	1164 (w) x 1669 (h) 728 (d) mm
Weight	~80 kg with rugged displays ~70 kg with office displays



OPTION 2: OFFICE DESKTOP MOUNTING

Same as Operator Chair with Pedals, except the following:	
Main Components	• Desk mounts for control panels and ACS 2 user panel (only if ACS 2 is in use). Rreplaces chair with armrests and base with display stand • Display: 32" office (110-240 VAC)
Dimensions	• Control panel with mount (2 pcs): 322 (w) x 343 (h) x 480 (d) mm • ACS2 panel with mount: 223 (w) x 217 (h) x 175 (d) mm (with keys) • Recommended minimum width of the desk (customer supply): 1,4 m
Weight	~30 kg (in total without table)
Housing	• Control and ACS2 panels: IP65 • Office display: ~IP20



ACS COMPONENTS





ACS ACCESS BARRIER CABINET

ACS Access Barrier Cabinet is a part of every Access Barrier set and includes necessary controls, indications and internal safety modules.

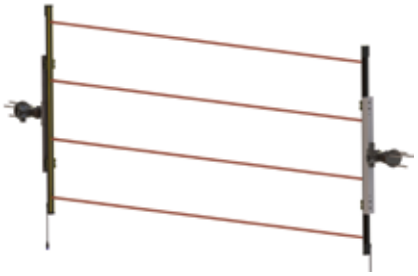
Dimensions	• 440 (w) x 800 (h) 250 (d) mm (height with space for cable connections)
Weight	16 kg
Housing	• IP54 • Enclosure material: stainless steel (AISI 304)
Operating Temperature	0 ... 35°C Air humidity (non-condensing) 15% ... 95%
Power	Input recommended from Power Supply Connection Box (24/48 VDC)

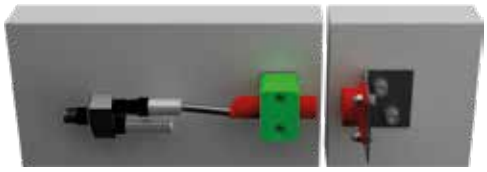
ACS ACCESS BARRIER CONTROL BOX (OPTION)

ACS Access Barrier Control Box is an optional component that provides the same controls and indications as ACS Access Barrier Cabinet but is used on the other side of an Access Barrier installation.

Dimensions	• 200 (w) x 650 (h) x 150 (d) mm (height with space for cable connections)
Weight	~10 kg
Housing	• IP54 • Enclosure material: stainless steel (AISI 304)
Operating Temperature	0 ... 35°C Air humidity (non-condensing) 15% ... 95%
Power / Signal	Input from ACS Access Barrier Cabinet (24 VDC)

ACS DETECTION DEVICE OPTIONS





OPTION 1: LIGHT CURTAIN (FOR PERSONNEL AND MACHINE DETECTION)

Tunnel Max. Width	~17 m
Dimensions	• 50 (w) x 1072 (h) x 50 (d) mm (light curtain device only) • 237 (w) x 1072 (h) x 200 (d) mm (with wall mounting brackets)
Weight	• 2,0 kg pair (light curtain devices only) • 14,0 kg pair (with wall mounting brackets)
Housing	• IP65 • Enclosure material: aluminum extraction profile
Operating Temperature	0 ... 55°C Air humidity (non-condensing) 15% ... 95%
Power / Signal	Cable set with connectors from ACS Access Barrier Cabinet (24 VDC)

OPTION 3: GATE SWITCH (FOR A PHYSICAL PERSONNEL GATE)

Assembly	Safety sensor and actuator for installation in a customer-supplied physical gate (max. distance between sensor and actuator: 25 mm)
Dimensions	• Sensor: M18 x 70 mm + cable • Actuator: 49 (w) x 49 (h) x 17 (d) mm
Weight	< 1 kg without cable
Housing	IP69
Operating Temperature	-25 ...+ 70°C Air humidity (non-condensing) 15% ... 95%
Power / Signal	Cable with connectors from ACS Access Barrier Cabinet (24 VDC)



OPTION 2: ROPE SWITCH (FOR MACHINE DETECTION)

Maximum Tunnel Width	~20 m (supplied with a 20-meter wire rope)
Dimensions	235 (w) x 85 (h) 69 (d) mm
Weight	< 1 kg (actuator without wire rope)
Housing	IP66
Operating Temperature	-25 ... 80°C Air humidity (non-condensing) 15% ... 95%
Power / Signal	Cable with connectors from ACS Access Barrier Cabinet (24 VDC)

COMMUNICATION NETWORK (MINELAN)



MINELAN ACCESS POINT

Standards	802.11 b/g/n, 2,4 GHz EU band
Security	SSID, WPA/WPA2
Dimensions	224 (w) x 147,7 (h) x 66,5 (d) mm
Weight	1,4 kg
Housing	IP68
Operating Temperature	-40 ... 75°C Air humidity (non-condensing) 15% ... 95%
Power	• Input: 12 ... 48 VDC • Power consumption: 7,68 W
Web Service Tool	Web-page for configuration and diagnostics of wireless network access points and onboard clients
Antennas	• Integrated small omni (default) • Discrete large omni (option) • Discrete directional (option)



NETWORK SWITCH OPTION 1: INTEGRATED NETWORK SWITCH AND POWER SPLITTER ASSEMBLY

Integrated assembly providing and unmanaged Ethernet switch and a splitter for chaining 48 VDC power supply.	
Dimensions	150 (w) x 150 (h) x 135 (d) mm
Weight	1,3 kg
Housing	• IP54 • Enclosure material painted steel
Operating Temperature	0 ... 35°C Air humidity (non-condensing) 15% ... 95%
Power	48 VDC
Connectors	Data: • 3 x Ethernet (M12) Power: • Input: 1 x DTP • Output: 1 X DTP (main power line), 1 x M12 (for MineLAN Access Point)



NETWORK SWITCH OPTION 2: DISCRETE NETWORK SWITCH

Unmanaged Ethernet switch.	
Dimensions	175 (w) x 100 (h) x 54 (d) mm
Weight	1 kg
Housing	IP65
Operating Temperature	-40 ... 70°C Air humidity (non-condensing) 15% ... 95%
Power	24 - 110 VDC
Connection Topologies	Power splitter for daisy-chaining available as a separate assembly
Connectors	Data: • 8 x Ethernet (M12) Power: • Input: 1 x M12



NETWORK CABINET

Network Cabinet includes a managed Ethernet switch that provides conversion of data communication media between fiber optic cabling and Ethernet copper cabling. Additionally, it enables power supply to system field components.

Dimensions	600 (w) x 760 (h) x 210 (d) mm
Housing	• IP54 • Enclosure material: stainless steel (AISI 304)
Operating Temperature	0 ... 35°C Air humidity (non-condensing) 15% ... 95%
Power	Input: 110 – 240 VAC, 50/60 Hz Output current: 10 A Output: 48 VDC (4 pcs connectors)
Connectors	Data: • 8 x Ethernet (M12) • 4 x fiber optic (SC) Power: • Input: 1 x VAC (lead through) • Output: 4 x DTP (with adapter cable)

FIELD POWER SUPPLY



POWER SUPPLY CONNECTION BOX

Power Supply Connection Box provides power supply to system field components.	
Dimensions	261 (w) x 350 (h) x 160 (d) mm (additional width for cable connections ~150 mm)
Weight	~8 kg
Housing	• IP54 • Enclosure material: stainless steel (AISI 304)
Operating Temperature	0 ... 35°C Air humidity (non-condensing) 15% ... 95%
Power	Input: 110 – 240 VAC, 50/60 Hz Output current: 10 A Output voltage: 48 VDC (4 pcs connectors)
Connection Topologies	Alternative connections per power box: • Maximum of 4 daisy-chained MineLAN access points • Maximum of 1 ACS access barrier cabinet plus 2 MineLAN access points

FIELD CABLING

Components	Separate pre-fabricated cable assemblies with connectors for use with the system field components are available: • Ethernet and VDC power supply cables in the following lengths: 10, 25, 50, 70 and 90 m • Power Splitters for chaining of power supply cables • Antenna cables in the following lengths: 1,5 , 5, 10, 20, 35 and 50 m

ROCK BREAKER INTERFACE CABINET (OPTION)



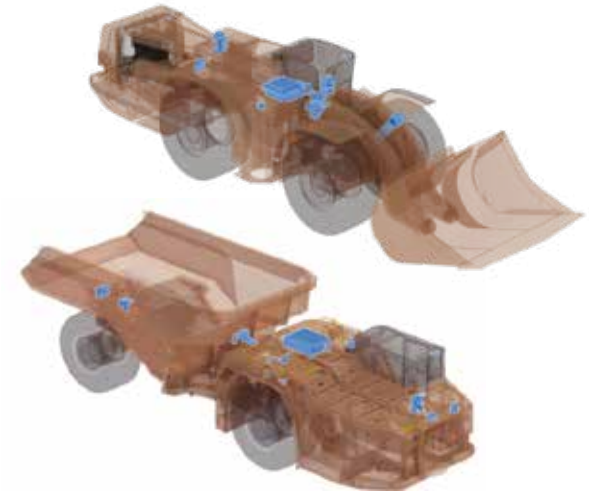
Rock Breaker Interface Cabinet (RBIC) is an optional hardware interface for remote controlled rock breakers, which are used at the dumping points of automated loader(s). Together with system functionality it enables two-way operation via 24 VDC signal interfaces: the loader will wait in a defined distance before approaching the dump point in auto mode, when the rock breaker signals that it is active, and RBIC signals the rock breaker, when the loader is reserving the dump point.	
Dimensions	600 (w) x 600 (h) x 210 (d) mm
Weight	~35 kg
Housing	• IP65 • Enclosure material: stainless steel (AISI 304)
Operating Temperature	-20...+50°C Air humidity (non-condensing) 15% ... 95%
Power	Cabinet supply input: 24 VDC Signal output: 24 VDC (4 pcs connectors) Signal input: 24 VDC (4 pcs connectors)
Connection Topologies	• Each RBIC has interfaces for up to 4 rock breakers • An AutoMine® system can have any number of RBICs

COMMUNICATION NETWORK (THIRD PARTY NETWORK REQUIREMENTS)

Internet Protocol (IP) -based data transmission is required with sufficient speed (latency) and throughput (bandwidth). Wi-Fi or LTE network is recommended for wireless communication. Validation testing for compatibility of a third party network with AutoMine® system components is highly recommended.

Standards	Wi-Fi : 802.11 b/g/n, 2,4 GHz LTE: Category 4
Bandwidth	Min. 10 Mb/s per equipment Min 10 Mb/s upstream per equipment
Latency	Wi-Fi: Max. 100 ms including handovers between Wi-Fi access points during roaming (Wi-Fi client connecting from one Wi-Fi access point to another) LTE: Max. 100 ms including core network

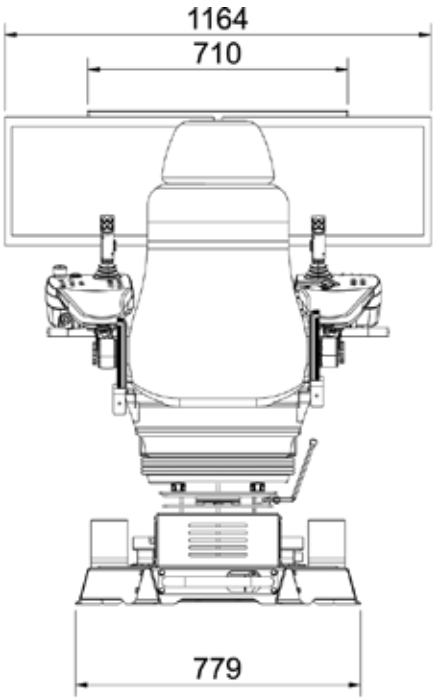
ONBOARD AUTOMINE® PACKAGE

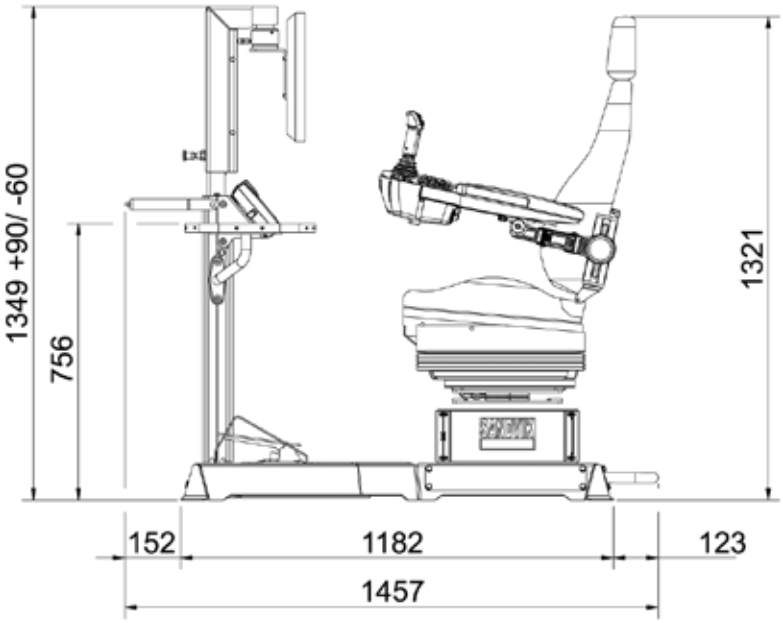


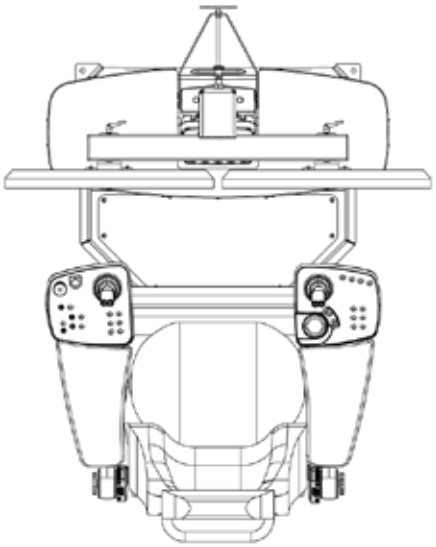
Main Components	Main AutoMine® Enclosure (individual assemblies without the main enclosure in case of the distributed onboard design): • InfraFREE™ navigation modules • Surface navigation module (optional) • Safety module • Network module • Video/audio module Other components: • Cameras (4 pcs) • Scanners (2 pcs) • MineLAN client & antennas or alternatively LTE router • Mode switch & lights • Articulation sensor • Bucket & boom sensors • Gyroscope sensor module (option)
Dimensions	Main AutoMine® Enclosure (only with single main box onboard design): 460 (w) x 250 (h) x 500 (d) mm
Weight	Main AutoMine® Enclosure (only with single main box onboard design): 35 kg
Housing	Min. IP54 depending on component
Operating Temperature	0 ... 35°C
Power	24 VDC

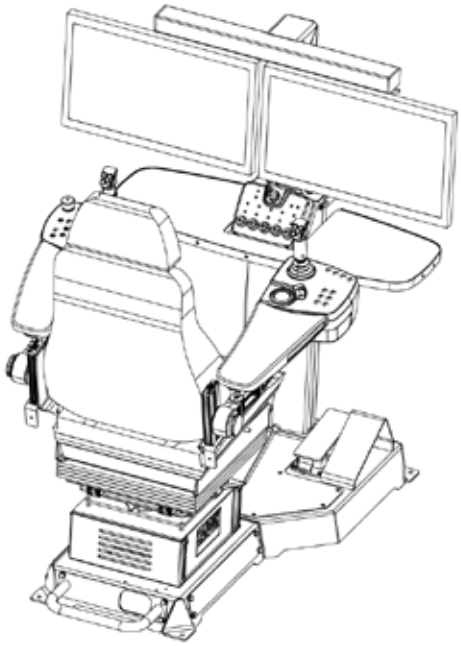
DIMENSIONS*

CHAIR WITH PEDALS AND OFFICE DISPLAYS





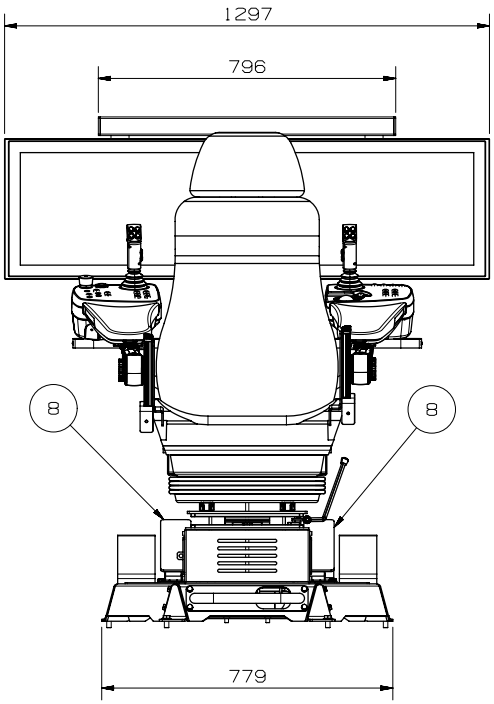


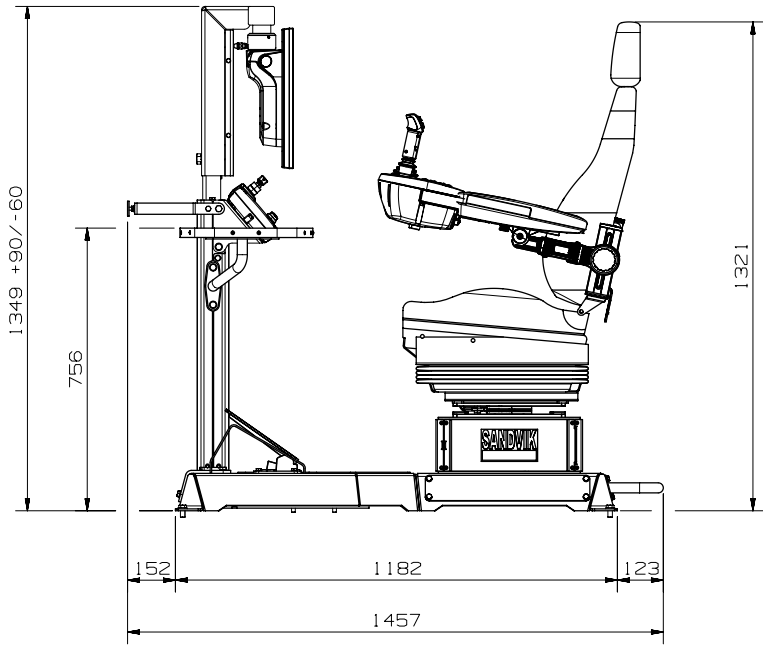


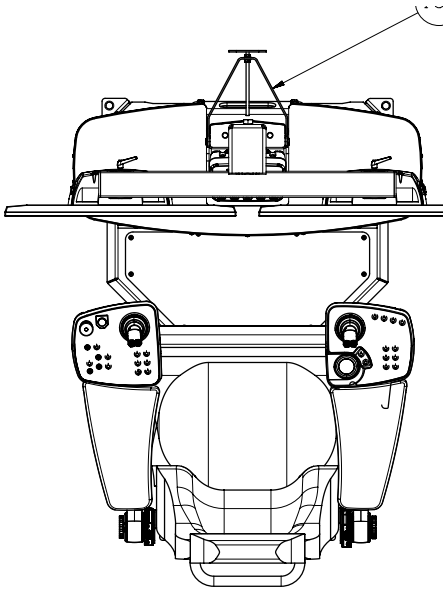
*Always refer to the installation manuals. Dimensions in mm.

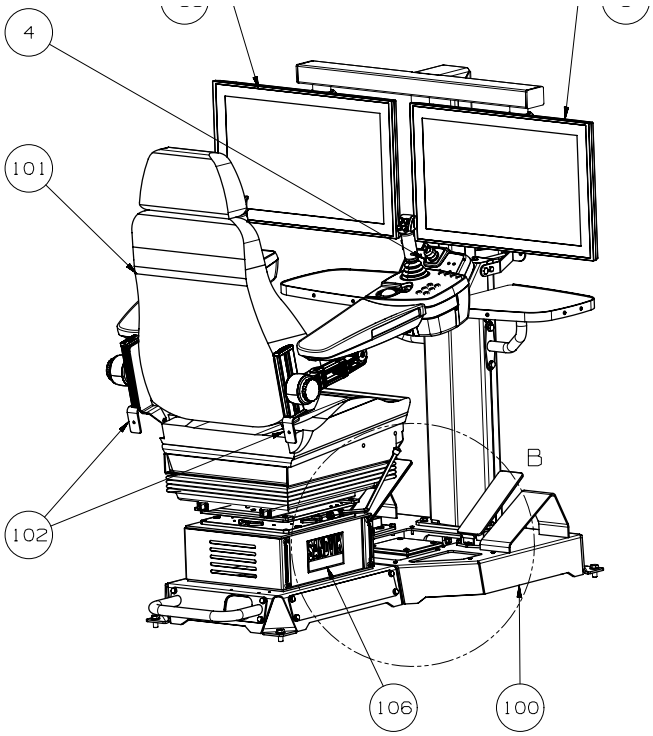
DIMENSIONS*

CHAIR WITH PEDALS AND RUGGED DISPLAYS





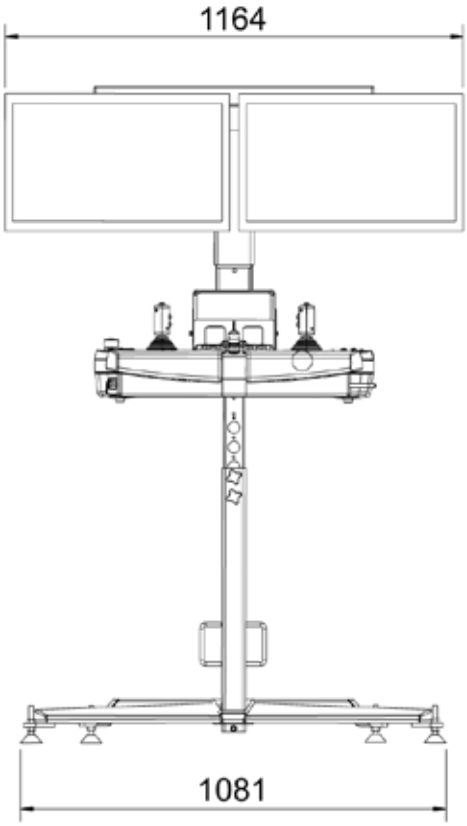


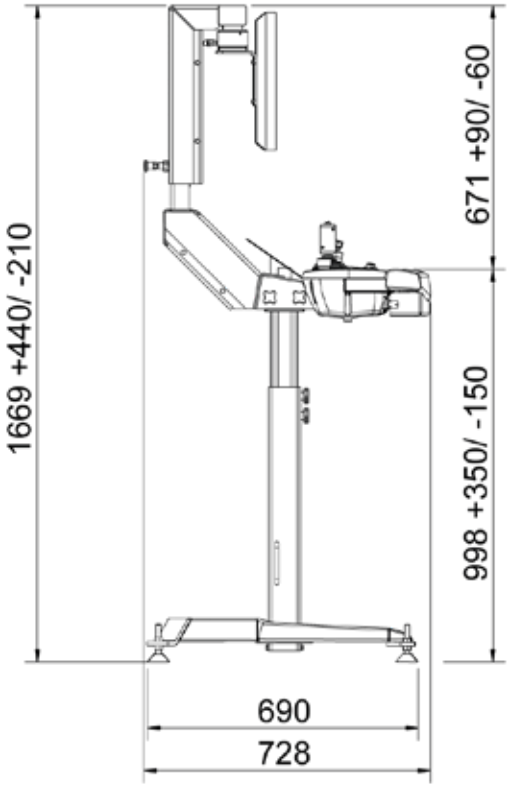


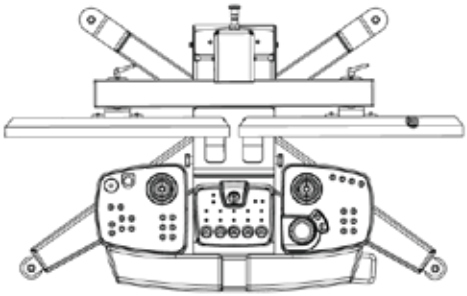
* Always refer to the installation manuals. Dimensions in mm.

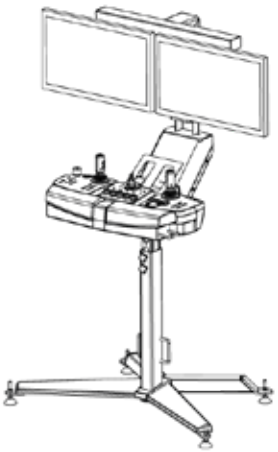
DIMENSIONS*

PEDESTAL STAND WITH OFFICE DISPLAYS





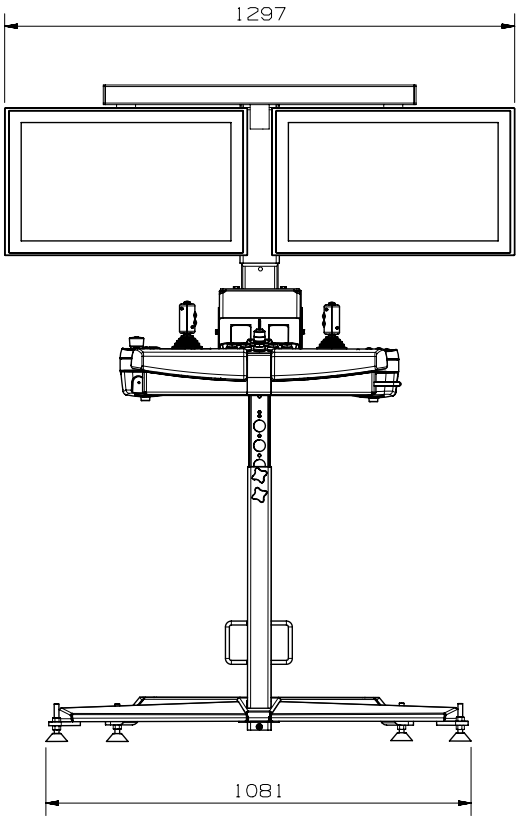


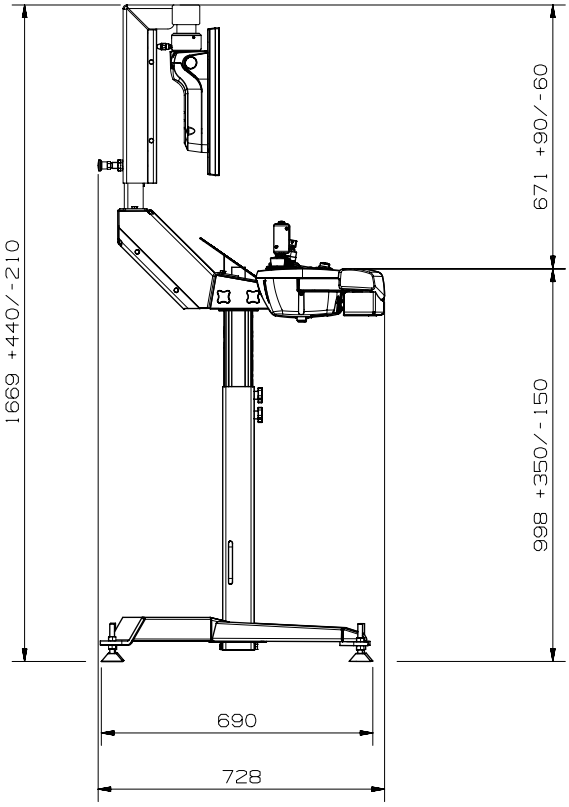


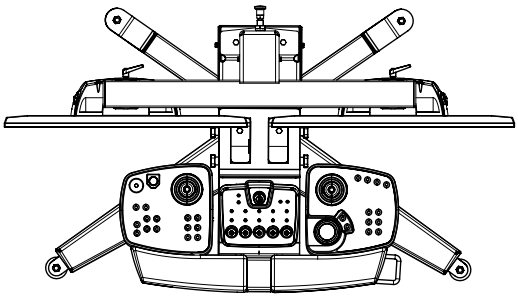
* Always refer to the installation manuals. Dimensions in mm.

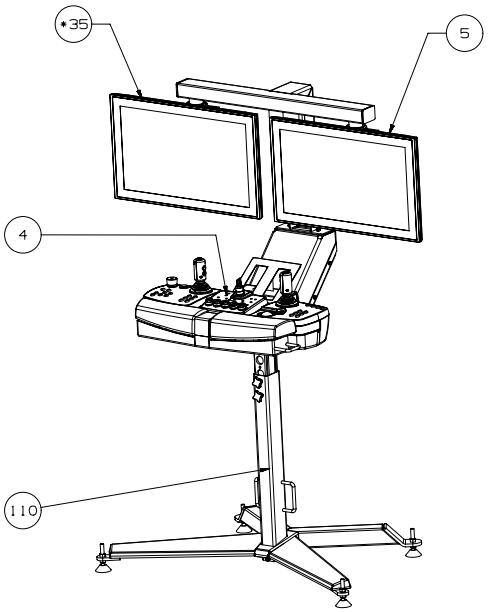
DIMENSIONS*

PEDESTAL STAND WITH RUGGED DISPLAYS





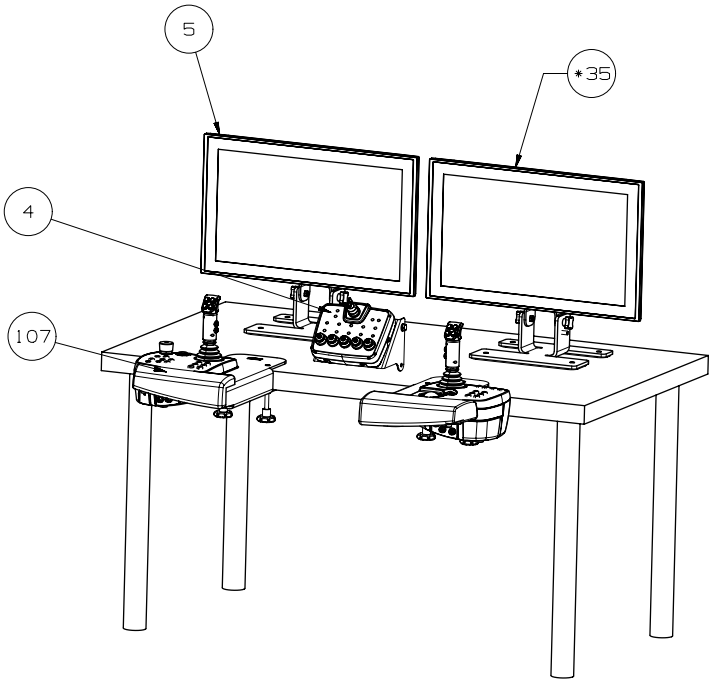


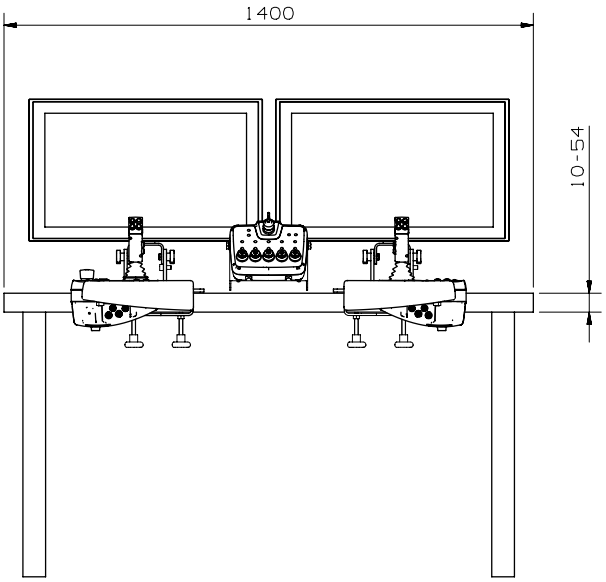


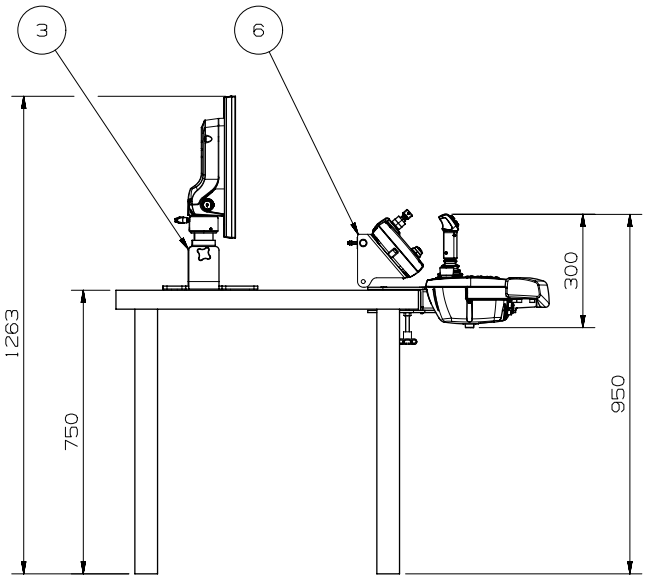
* Always refer to the installation manuals. Dimensions in mm.

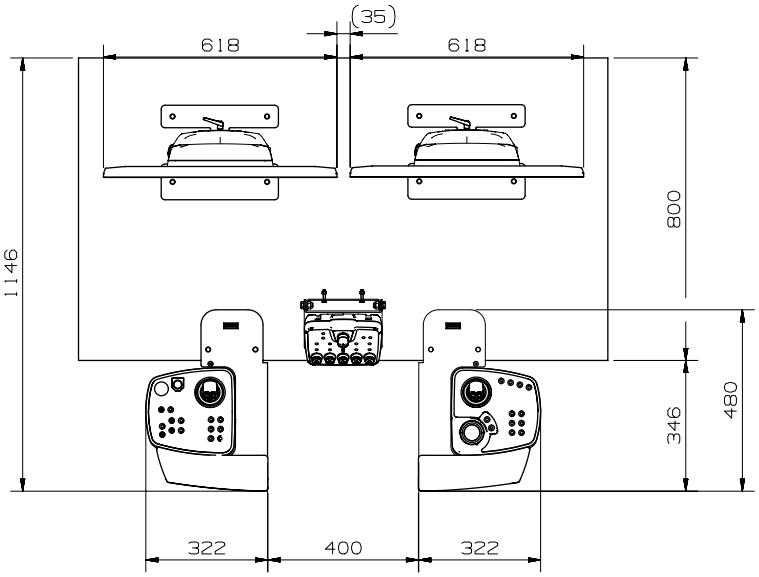
DIMENSIONS*

OFFICE DESKTOP MOUNTS WITH OFFICE DISPLAYS





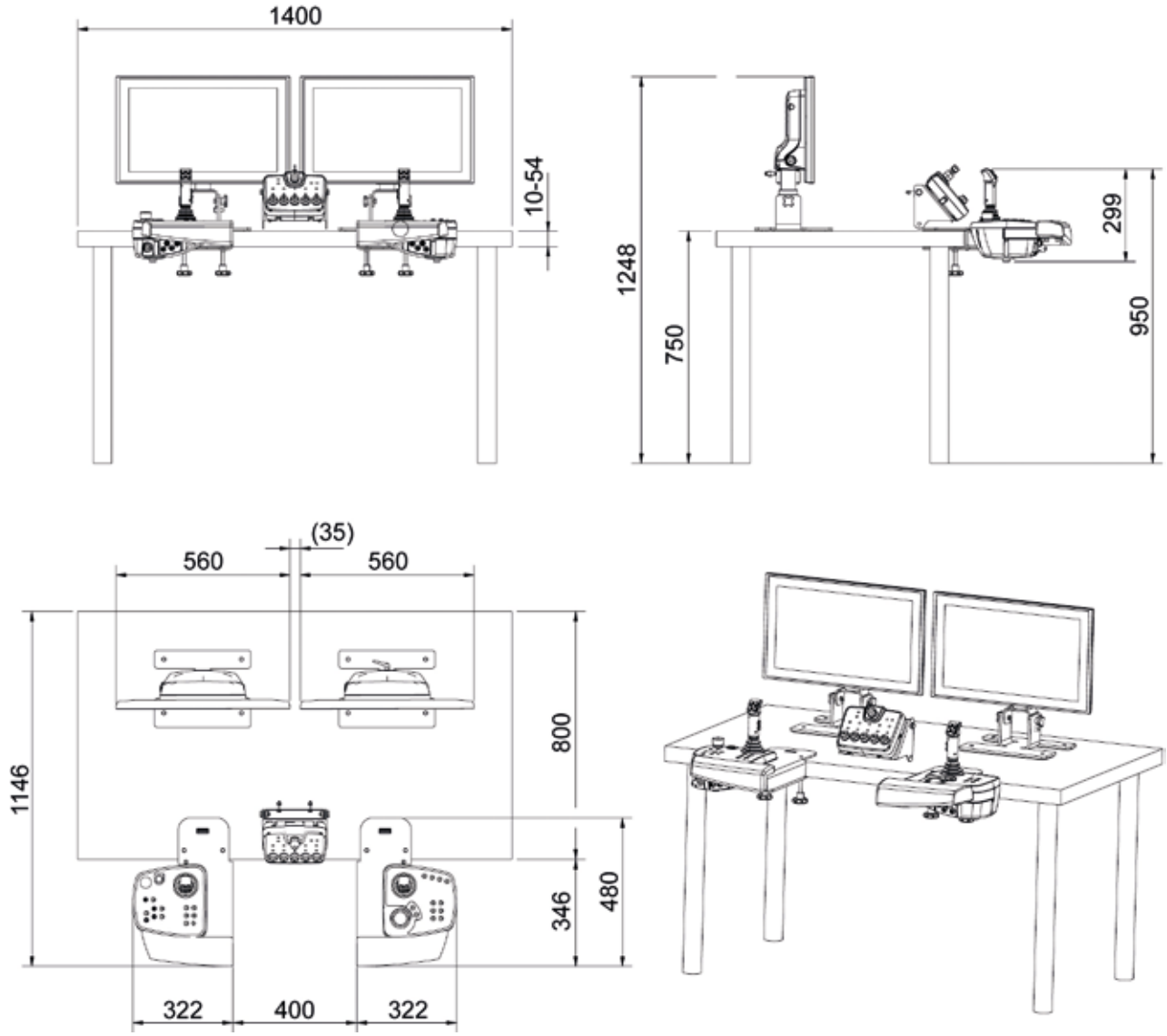




*Always refer to the installation manuals. Dimensions in mm. Table measures as recommendations for stability.

DIMENSIONS*

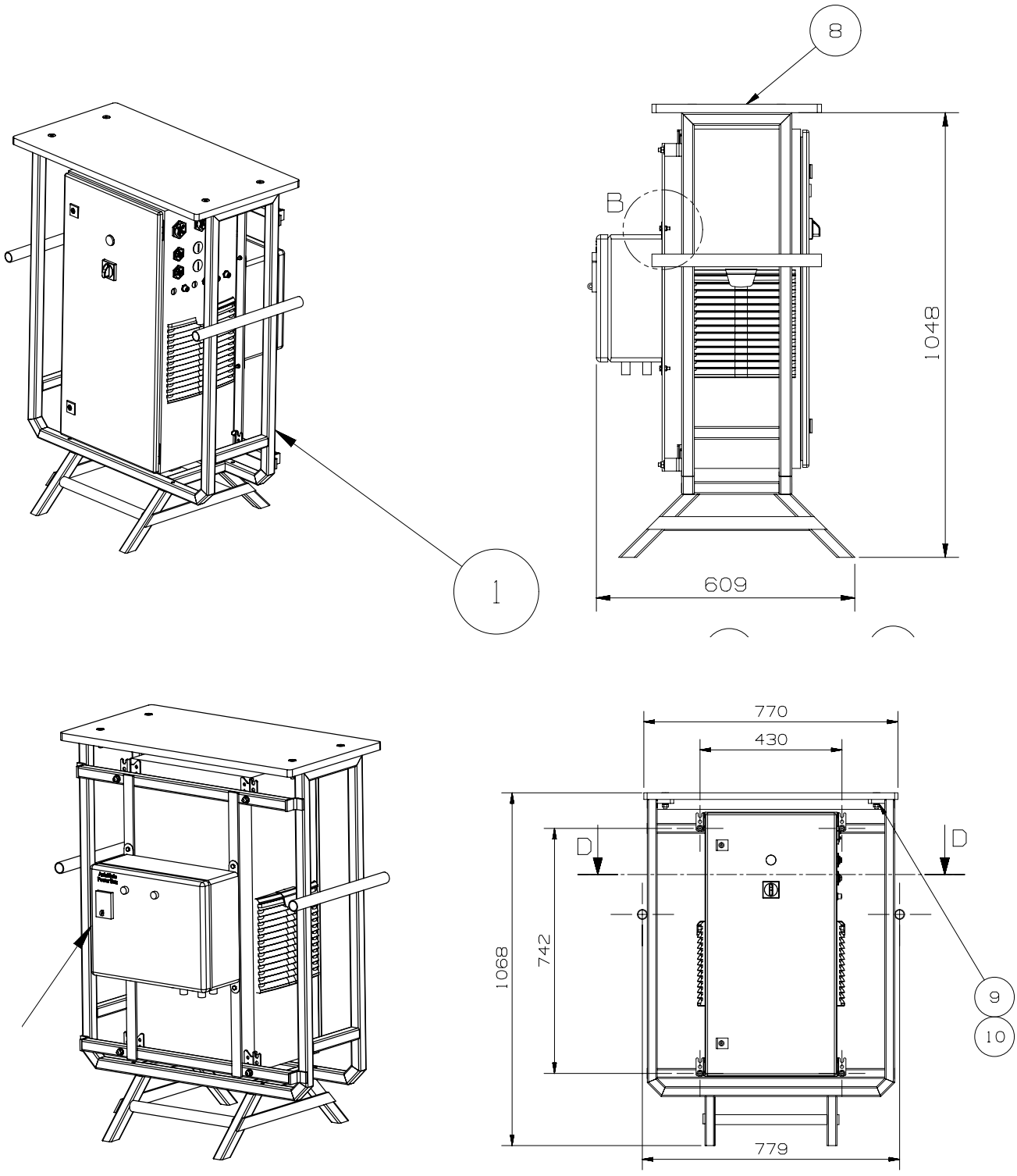
OFFICE DESKTOP MOUNTS WITH RUGGED DISPLAYS



*Always refer to the installation manuals. Dimensions in mm. Table measures as recommendations for stability.

DIMENSIONS*

OPERATOR STATION CABINET



*Always refer to the installation manuals. Dimensions in mm.

Sandvik Mining and Rock Technology reserves the right to make changes to the information on this data sheet without prior notification to users. Please contact a Sandvik representative for clarification on specification and options.

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