

PORTABLE CAMERA CONTROL UNIT

The system controls must be contained in a damage resistant housing with flip down control lid, embedded keyboard and carrying handle.

The CCU shall include circuit protection for individual electronic components. This is to be incorporated in case of power interruption, surges, component malfunction or inadvertent mis-operation of the system.

Control unit must be available in configurations for complete portability with embedded color video monitor, rack mount in a vehicle installation and portable without monitor.

Control unit not to weigh more than 14Kg.

Control unit not to be larger than (510 w x 460 d x 400 h) mm

Control unit to operate on 230V / 50W / 2 amps

The Camera Control Unit shall contain the following controls, inputs and outputs:

Inputs/Outputs

Mounted in front for portable systems and in rear for truck mount systems

Portable system to have fold down cover with keyboard input

Video out BNC connector

RS232 for output of text and footage data to software

Hour meter

Red and green fuse indicator per slide out card

Control cable receptacle to cable reel

Keyboard for text generation

90V - 240V universal AC power supply

External video BNC connector

Pendant control cable receptacle

External D connector for pendant and via pendant cable

Controls

Power on/off switch

Removable Pendant with controls

Pendant to have keyway mechanism of docking to CCU

Sealed membrane style buttons with LEDs

Forward/Reverse, Left/Right tractor joystick control

Rheostat Variable tractor speed control

Camera pan and tilt joystick control

Single click for normal Zoom IN/OUT

Double Click same button for full IN/OUT Zoom position

Hold down for longer than 1 .5 sec for fast zoom IN/OUT

Shutter speed button for Up, Down and Auto

Focus button for far, near and auto

Button for centering pan and tilt to center forward position

Double click home button to set wide zoom setting

Joystick control of pan and tilt

Rheostat control of lighting

Rear view camera toggle button

2m pendant control cable

The proposed system shall have all electronic controls for the CCU mounted on modular slide out cards for easy repair/replacement.

The CCU shall operate larger or smaller crawlers with no need for additional control unit or cable upgrades.

The CCU shall operate minimum 100, 125 and 225 mm ID crawlers without modification to the cable, control unit or any other part of the system.

CCU must have 5 slide out cards which can be removed from the control unit with a single screw.

Slide out video card

Slide out text generator card

Slide out 12v power card

Slide out main power card

Slide out camera card

TEXT GENERATOR

The system shall include a video text-generator capable of displaying alphanumeric text material directly onto the video monitor. The facility for this data shall remain in memory when the unit is turned off and must be retained without system use for a minimum of 30 days.

The videotext generator shall supply at least seven separate screen page memories for text storage and display.

Screen page memories must be selected by no more than 2 keystrokes at any time during the inspection.

Each screen page memory shall contain a minimum capacity of 32 characters across by 20 lines down, allowing for flexibility in formatting footage, date, time, job descriptions, defect codes, etc In any location desired.

Characters generated by the video text generator shall be available in The following formats and shall be accessed during any inspection by means of no more than 2 key strokes:

Full colour for both background as well as text.

Meterage of cable extended shall appear upon the screen in conjunction with the cable counter. Reset or preset of the footage count shall also be possible by use of the videotext generator.

Time and date shall be maintained by keypad and displayed on screen at any position selected by the operator. Date and time shall keep real time and remain in memory even when the unit is turned off.

At least seven special fields shall be provided into which recurring information may be programmed and selected for entry onto the screen by no more than two keystrokes. These fields shall have a capacity of no less than 30 characters and shall be placed onto any screen page and any screen position selected by the operator. These special fields shall retain all information when the unit is turned off, for a minimum period of 30 days.

A "Help" directory shall be provided and may be accessed, for monitor display. The "Help" directory will be permanently retained in memory and contain a short description of all text writing operations.

A keypad shall provide all letters, numbers, punctuation marks and signals found on a QWERTY keyboard. In addition, arrows pointing UP, DOWN, RIGHT and LEFT shall be provided by the character set.

PAN & TILT COLOR ZOOM CAMERA

The pan & tilt camera must connect directly to the cable, and minimum 100, 125 and 225mm ID crawler without modification to the cable, control unit or any other part of the system.

When connected to any crawler there can not be external wires,connectors, clamps or tie-downs

The camera will pan (+/- 175°) and tilt (+/- 135°) allowing for full view of laterals and joints. Camera will have the ability to view behind crawlers to inspect upstream lateral rubber seal on gravity flow PVC pipes.

Pan and tilt will have mechanical stops to avoid slip-ring maintenance issues and prevent camera from inadvertently being directly positioned into dirty flow at bottom of pipe.

Camera must have 10X optical 4X digital zoom capability for viewing up laterals and magnifying observations.

The Camera must be a 0.5 Lux 480 line PAL Camera or better

Camera construction shall include all solid-state circuitry designed to withstand shocks and vibrations while being pushed, pulled or propelled through the pipe.

All camera electronics shall be of modular construction for ease of exchange and repair, and shall be designed to facilitate future upgrades.

The front of the camera housing shall have a windshield made of impact resistant, distortion-free material.

The housing shall be fully sealed and waterproof (IP68) to withstand external pressure up to 15 psi without damage or leaking.

The camera power supply shall be provided from a solid-state power source and the camera input shall be 12 volts DC. The lighting for the camera shall be supplied through an isolated power supply and shall regulate the light voltage up to a nominal 36 volts DC.

Pan/Tilt Motor power 12V/3Watt

The camera shall be designed for easy removal and installation from the cable or tractor by using a single T-bar tool to keyed stainless steel waterproof swivel loc-tite camera and cable connections. Other types of connectors will not be acceptable.

Camera illumination must be provided with a minimum of 28 field- replaceable LED's that have a 50 degree lighting angle and provide 45000mcd/piece to light pipes up to 1500mm diameter

The camera shall have a visible internal pressure indicator allowing the operator to detect a pressure loss. A solid red indicator will show if the system is over-pressurized, green indicator when the system is holding 1 bar of pressure and blinking red indicator for when pressure is below 0.7bar.

Camera shall have shraeder valve for purge and pressurization of camera-body.Pressurization prevents the ingress of water during an accident and provides a dry air internal environment to prevent fogging of inner lens during changing external temperatures.

Camera will pan and tilt at the same time to increase speed of inspection and home position placement when continuing forward. Cameras that require a two-step process by having to pan and then separately tilt will be deemed unacceptable.

Camera must not weigh more than 1.7kg

Camera must have a maximum size of 79mm x 110mm x 75mm in order to fit into a diameter of 88mm.

Rotation axle must be made of a minimum of 15mm stainless steel

Following camera functions must be able to be controlled via a Remote pendant:

Single click for normal Zoom IN/OUT

Double Click same button for full IN/OUT Zoom position

Hold down for longer than 1 .5 sec for fast zoom IN/OUT

Shutter speed button for Up, Down and Auto
Focus button for far, near and auto

Button for centering pan and tilt to center forward position
Double click home button to set wide zoom setting
Joystick control of pan and tilt
Rheostat control of lighting

Pan and tilt must have integrated clutch for pan and tilt motor

150mm to 600mm PIPE DIAMETER STEERABLE MOTORIZED CRAWLER

The system shall include a gear driven; all wheel drive tractor to carry the camera for rapid remote inspection of pipes ranging from 150mm to 600mm diameter.

The tractor shall have forward/reverse and left/right steerable movement via the pendant control on the CCU.

The tractor shall provide sufficient traction, under suitable conditions, to tow 200m of transmission cable. Such traction shall be provided by six gear driven wheels with tapered tires. Tractors propelled by chains, belts or continuous tracks will not be acceptable.

Both the camera and cable shall be easily removed from the tractor unit with a T-bar tool to facilitate productivity and service. This connector shall have a lifetime warranty. T-bar tool turns a cam lock no more than 50mm to secure and release the cable or camera. Systems that need more than one tool, screws or wires will be deemed unacceptable.

The tractor shall have a maximum size of 76mm wide by 84mm high. To allow for proper clearance in 150mm and lined pipes.

Front bottom edge of crawler shall be solid anodized aluminum and be curved upward to assist with moving over and through common debris and obstacles

To allow for performance in soft sediment and debris and ease of use the tractor shall weigh a minimum of 8kg and 9 kg with camera

2-20 watt DC motors shall power the tractor.

The tractor shall be no longer than 580mm with the pan and tilt camera in order to easily navigate through 90-degree inverts without rolling.

In order to prevent leaking and bending due to torque and stress generated by a small steerable crawler, the tractor chassis shall be a single piece of machined aluminum with only a top plate to access the control boards, a bottom plate to access the motors and two zinc plated brass side cover plates to access the gears. Bronze or brass bodies or soft metals will not be acceptable for body chassis.

All wheels to have tapered edges to conform to pipe sidewall

The tractor shall have machined key fitting on all 6 axles to facilitate easy use and ensure an exact fit with all wheels. Machined axle key must be able to be replaced in the field without having to replace the axle. Crawlers without keyways or keyway fittings that can be replaced in the field without removal of the axle will be deemed unacceptable

The tractor shall include 3 wheel sizes and spacers suitable to accommodate pipe inspection in 150 through 600mm pipes. Spacers and wheels sizes shall attach with a keyway and single screw. No plates or spacer-bars will be accepted.

Tractor shall work with the following standard and optional wheel sets

Included

Set of 4 common 36mm dia by 20mm wide spacers

- (6) 86mm dia rubber wheels
- (4) 110mm dia grooved rubber wheels
- (4) 110mm dia soft composite grease wheels with traction grit impregnation
- (4) 135mm dia grooved rubber wheels

Optional

- (6) 86mm dia soft composite grease wheels with traction grit impregnation
- (4) 135mm dia soft composite grease wheels with traction grit impregnation
- (4) 135mm dia pointed carbide wheels
- (4) 135mm dia by 66mm wide sediment rubber wheels

The tractor must have a single waterproof screw-on connection port or additional upwardly angled large pipe lighting located behind the center area of the crawler.

The tractor shall have the ability to add high intensity LED low profile auxiliary lighting that is remotely controlled via a rheostat controller on the operator pendant.

Crawler must fit in 200mm diameter pipe with dual auxiliary lighting attached

The tractor must have the ability to add a rear viewing camera and rear lighting for debris avoidance and cable management.

Rear viewing camera and lighting must use same connection port as auxiliary lighting.

Tractor must have two mechanical screw-down holes 20 mm apart to solidly adhere lighting and rear view camera.

Crawler must fit in 200mm diameter pipe with rear viewing camera attached

The tractor shall have a visible internal pressure indicator allowing the operator to detect a pressure loss. A solid red indicator will show if the system is over-pressurized, green indicator when the system is holding 1 bar of pressure and blinking red indicator for when pressure is below 0.75bar.

The tractor shall have a tilting rear cable connector that points vertically when deploying the system into a manhole but can tilt into a horizontal position during operation in order to protect cable and connector during deployment.

The tractor shall have a strain relief system for the cable that is comprised of (2) high strength steel cables and a stainless steel capture device to secure to cable brass fitting.

The rear tractor cable connector shall have a machined mechanical cable connector that captures (4) 2mm stainless points and positively locks the cable to the crawler body without damage to the cable or connectors.

Crawler and cable stainless connectors must have a lifetime warranty

The tractor shall allow for camera riser kits to allow for the manual lift of the camera above the crawler for better centering in pipe diameters up to the stated 600mm capability and to view in high water level/flow conditions. Centering camera is required to conform to WRc recommended practices and to be able to pursue SSET camera upgrade opportunities.

- Riser to provide for 50mm rise from base position
- Riser to provide for 125mm rise from base position
- Hardware to raise auxiliary lighting above new camera position

The tractor shall allow for a removable bottom plate weight which can be used for increase crawler weight by 2kg. 2 screw-bolts must attach this plate for easy removal.

The tractor shall allow for a 512 or 33 Hz integral sonde facilitating locating crawler location with a receiver.

The tractor must have a standard inclinometer for tracking and electronically outputting pipe rise and fall (grade) and integrate data with database inspection software.

To preserve the value of this investment for the future, tractor must have the ability to be upgraded without modification to the tractor, control unit or cable. Following technologies must be presently available:

SSET Camera/Scanner
40:1 Zoom camera
Integral rear viewing camera
Laser Profiler

60% or more of the entire length of any camera must be protected and housed within the crawler to prevent pressure and damage on front camera connection point and to keep even balancing when inserting the crawler into a manhole or basin.

LIGHTWEIGHT TRANSMISSION CABLE

200m of continuous length multi-conductor cable shall be provided. The cable must be Kevlar reinforced and have a minimum break strength of 230kg.

The cable shall be no greater than 7.2mm in diameter.

The cable must not weigh more than 7.8kg per 100m

A connector strain relief fixture must be provided to fit the cable and work with steel strain relief on the crawler side.

The cable must be able to connect to the following directly without any modification

- Pan and tilt camera
- Axial forward view camera
- Pan, tilt and 40:1 zoom camera
- Camera raise kits
- 100 mm minimum ID Pipe capable crawler
- 125 mm minimum ID Pipe capable crawler
- 225mm Minimum ID Pipe capable crawler
- SSET camera for manhole and pipe scanning

Cable must be able to be removed from cable reel without Tools, single electrical connector for easy replacement

Cable must have tough outer jacket to resist tears and scrapes

Outer jacket must be smooth to reduce friction

Crawler connect end must have a minimum of 200mm steel armored jacket to prevent cable damage while going around pipe bends and during entry.

Crawler connect end must have solid stainless steel bayonet style connector that locks with a single quarter turn with lifetime warranty

Crawler connect end must have connector that has electrical keyway for proper alignment of cable to camera or crawler connector without damaging electrical pins

Crawler / Camera end of cable must be minimum 12mm stainless wall thickness with minimum 2mm points to mechanically secure to crawler or camera connector

Cable must be able to be directly reterminated without the need for epoxy. Scotch cast style units that require lengthy cure times will be deemed unacceptable.

Cable must be able to be used with fully automatic cable reel, manual cable reel and cable reel with auto-assist motors for easy management.

Cable must be able to work with push camera adapter for axial camera in order to use the same camera for the crawler and to push through smaller lines.

Cable must have easy single twist style connector for tool-less and easy connection to the following available cable drums.

Maximum 200 meter manual cable reel with Meter counter

Maximum 200 meter cable reel with motorized rewind assist

Maximum 200 meter fully automatic and motorized cable reel

MOTORIZED AUTO-SENSING CABLE DRUM

A cable drum shall be provided to contain the cable for camera and crawler operation.

The hub of the cable drum shall be equipped with a continuous contact slip-ring assembly to allow the cable to be dispensed and retrieved while the camera and tractor are operational.

The slip ring contacts shall be of an alloy of gold and rhodium and must be housed in an environmentally sealed housing. Cable feed out and retrieval must happen **AUTOMATICALLY** via a motorized system with sensors that operate the cable drum at the exact speed and direction of the crawler. Cable is paid-out or "pushed" toward the crawler so the crawler does not have to pull the cable off the reel and reduce power and traction. Cable reels that require operator control or lack the ability to operate in tandem with speed and direction of the crawler without adjustment will be deemed unacceptable.

Cable reel must have a level wind system which neatly rolls and stores cable without excessive loops or tangling.

The cable drum must have a red lighted emergency stop switch.

To further enhance safety, the cable drum must have an automatic shut down if the cable reel is tilted beyond 30 degrees.

The cable drum must have a normal and inverse switch which allows the crawler controls to be used normally if the crawler was to flip and be operated in an upside down position.

The cable drum must be able to operate in both automatic and manual modes.

System must have back-up manual crank arm in case of power loss

Front panel must have LCD readout of footage

System must have outward cable rolling arm to help with pressures of cable when crawler is being reversed and for allowing for easy deployment when crawler is moving forward. Roller and arms must be able to be stored in an upright position when not in use to facilitate portability.

Cable reel system must have overheat sensor protection so motors will not be destroyed if the reel were to pull on an object that is not moving for a long period of time.

The cable drum must have speed and torque controls to adjust for different pipe conditions and user preferences.

The cable reel shall not weigh more than 45kg with 200 m of cable.

Cable reel must have top handle to be able to be carried easily into the field

Cable reel system must come with 6m control cable to control unit and have ability to work with a 50m extension cable.

Cable drum must come with stationary mounting plate where cable drum remains secure, but can easily be removed for maintenance shipping, or portable use without the use of any tools or loose hardware.

The system shall include a meter counter attached to the counter arm assembly which extends from the cable drum.

The meter counter assembly shall be constructed of machined aluminum parts and shall include the necessary guide wheels to maintain cable tension.

The meter counter shall measure passage of the cable from the wheel graduated in 0.01m steps up to 200m.

The meter counter shall function electronically and transmit meterage data for monitor display and video recording.

Size of cable drum must not be greater than 355 x 540 x 510mm (W x L x H)

Cable drum must work with minimum 100mm ID pipe crawler and minimum 225mm pipe ID crawler without any modifications.