



GEER: HEAD

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Max (a.k.a., Ernie) the Ford Showcase Robot

Not A Model, But Not Bad

My Name is Max

Max may not do justice to the latest European bikini, yet exhibition-goers can't take their eyes off of him. Max the exhibition robot (a.k.a., Ernie when in use at Ford auto shows), which has appeared at Ford auto shows as the Ford Robot, is the mechanization of Mannetron, an exhibit robotics company in Battle Creek, MI.

Max is an "anthropomorphic, teleoperated" robot, meaning it has human-like form and function and can be operated remotely via RC technology — in this case, a very sophisticated, operator-worn sensing suit based on virtual reality technology.

As with any performing artist, Max's real work is done "behind the scenes" or apart from the show itself. Max bears the burden of repeated setup, take down, storage, and

shipping for show after show around the globe.

To stand up to this routine, Max's materials were carefully selected: brass, aluminum, nylon, and stainless steel. His hands are a combination of lexan, aluminum, and stainless steel. His head and body shell are polyester reinforced by fiberglass (long live the polyester suit!).

This exhibition robot is endowed with a "36-axis, real-time, motion control system." Max's many axis of movement and degrees of freedom enable lifelike interaction with his audiences. Max's many movements break down to "19 aquadraulic motions," aquadraulics being water-based hydraulics, and "17 direct drive electromechanical motions."

Max's voice, which comes from a human operator, is translated by a Roland Voice processor to make it sound like Max every time, whether

the operator's voice is high or low, male or female. Two high direction shotgun microphones are used to pick up questions from the audience so Max's operator can hear them and respond.

One of Max's "eyes" is a "head mounted mini hi-res color camera" inside his head. Additional CCTV cameras and monitors — provided by the client putting on the show — give the robot's operator two angle views to aid observation of and interaction with the crowd.

Max the Robot Requires Maximum Construction

Knowing Max must travel the world (US, Europe, Middle East, and Asia) from show to show and endure drop-offs, setup, performance, and

Max the Ford robot, an exhibition robot adapted for the Ford auto shows in this case, winning best of show.



Max side angle, working the crowd, pleasing children young and old.



Max (a.k.a., Ernie) gestures to the ceiling as he strikes a pose.



ROBOT KIOSK

Other Mannedtron creations include interactive media stations or kiosks. The kiosks consist of a bright 23-inch LCD screen offering an HD wide screen viewing format, a formidable sound system, a quick response touch sensor, as well as a powerful computer and graphics processing.

take down repeatedly, its creators at Mannedtron made sure both Max and its shipping enclosures were equipped to the max!

The base on which Max stands houses all the electrical and hydraulic support systems. Nineteen of his movements are enabled by 22 precision controlled water-based hydraulic pumps. The base also houses "precision DC servo systems," as well as power supplies and two "industrial PCs with 16 DSP motion control sub processors." The base also houses a main power switch and a pressure gauge for the hydraulics.

For shipping, Max is placed on top of his base and covered by a protective cover. All other systems ship in crates and flight cases.

Max's base frame — on which he stands during shows — ships at a weight of 2,200 lbs. Its support equipment, sensor suit, tools for adjustment, maintenance and repair, and spare parts are shipped at a

weight of 660 lbs. And, finally, all control system computers and other spare parts and tools are shipped at a weight of 220 lbs. Max, you're a mighty heavy robot.

During performances, Max's base frame is usually hidden by a surrounding structure dedicated to the theme of the particular show. Everything that isn't the robot itself or its frame is housed in a separate control room, constructed on site for the occasion.

Major Max to Room Control

There in the control room, Max's sensor-suited human operator is hidden from view, adding to the impression that Max is alive and acting completely independent of technical support or human intervention.

The body-worn sensor suit measures all robot movements "in real-time at 30 frames per second."

According to Mannedtron's project coordinator, Peter Jungen, Max creates a fascination with the crowd by creating "the illusion of a living machine." Max does this by exhibiting fundamental traits of verbal and non-verbal communication as we do.

Max grabs people's attention and holds it by recognizing them, turning towards them, looking at them, saying hello, and responding to questions.

The sensor suit makes all this possible. The suit tracks all Max's body and head movements. Max's head mounted eye (camera) tracks in tandem with the remote operator, who can see what the camera sees through virtual reality goggles. As the operator moves and responds to the audience, so does Max.

The sensor suit has aluminum mechanical parts that parallel the operator's arms. The sensors collect information about the operator's movements and translate them into Max's movements. The suit does all this without restricting the operator or making her/him uncomfortable.

According to Jungen, most of the suit's sensors are "conductive plastic rotary or linear sensors made by Midori (Japan)." Even Max's finger movements parallel those of the operator. This is enabled by flex sensors in Max's sensor gloves.

Max's upper body movements are measured by "solid-state gyros." Head motion is tracked by a "three axis inclinometer/magnetometer module made by crossbow." "The jaw motion is generated from the operator's voice pickup using a custom designed tracking circuit," says Jungen. No detail of human motion has been left unconsidered.

A PC loaded with Syncon (Mannedtron's robot performance control system) processes all input signals

How do they sell any cars or car ideas with Max holding the center of attention? I see one guy looking at a car while everyone else is studying Max.



Ernie when at the Ford shows is the Mannedtron robot pictured in his guise as the Ford robot here.



Mannedtron's sensing telemetry suit with human operator shows virtual reality goggles, mic and headset, aluminum arm, leg, and body sensing equipment and sensor gloves.



from the suit in real time using “digital filtering, scaling, and limiting.” Any of Max’s motions can be captured, recorded, and played back, as well, though live performance is more real and preferred.

The sensor suit and control system in the make shift control room are connected to Max via a 300-foot stretch of cabling. The suit includes a microphone, permitting the operator/wearer to be Max’s voice.

In the control room with the operator and suit, you will find Max’s audio mixer, which can be connected to a power amp or another mixing console, using XLR outputs.

Along with the 300-foot cable stretched from the control room to Max, are two audio cables so you can transmit the “line level signal” to the robot.

Max Got the Power

To keep the robot’s various systems from failing, power output to the robot needs to be reliable. It can’t have line spikes, either. So, Max needs to run on his own circuit. Power needs to be provided both to the control room and to the robot, as well (30 amps to both locations running on 110 VAC at 50-60 Hz).

Again, the main cable from the control room to the robot also contains coaxial cables that can be used to connect the cameras and the control room.

Max can also be programmed to run independently through a series of preset movements. In this way, it can capture the audience with gestures and pre-recorded speech or a song and dance number. While Max needs little or no break time, the operator does, and this programmed segment permits them just that.

Max is farmed out for exhibits and marketing purposes with an able technician, ready to help you use the technology with relative ease.

Helping Max Keep His Cool

Though Max doesn’t need breaks, he does get hot and

ROBOT CONTROL SYSTEM UPDATE

Syncon VI Robot Performance Control

Max and other Mannetron robots are controlled by Mannetron’s Syncon control system. The system has recently been updated to Syncon VI. Whether lifelike “swimming whales, roaring dinosaurs, or Max himself, these animations are produced by the latest in top notch control system technology.

Take a 30-foot robotic T-Rex dinosaur, for example. Assuming full animation and the illusion of real life, the robot has to be capable of many movements requiring massive drive motors. These motors would have to enable many tons of force. Such a robot would also require very small, intricate, and precise movements, “such as a nostril flare or eye blink.”

The new Syncon VI ties all these movements together, controlling them to create an orchestrated animation simulating a living creature.

needs to keep his cool. Airflow is provided between the stage and frame by fans mounted underneath the robot. Fans should provide at least 500 cfm of airflow. But, if the normal temperature is above room temperature, an air conditioner will be needed, as well. **SV**

RESOURCES

www.mannetron.com

Parents to Max and numerous anthropomorphic and other robots.

<http://mannetron.com/downloads.htm>

Several cool videos of Mannetron robots in action.

<http://mannetron.com/anthro.htm>

Anthropomorphic robots.

<http://mannetron.com/rollaround.htm>

Mannetron’s roll-around robot greeter.

<http://mannetron.com/humanoid.htm>

Mannetron’s advanced humanoid robotics.